"A PROSPECTIVE STUDY OF OPEN PREPERITONEAL VERSUS ANTERIOR APPROACH FOR RECURRENT INGUINAL HERNIA"

Dissertation submitted to

THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY

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For the Award of the Degree of

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DEPARTMENT OF GENERAL SURGERY

MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL

MADURAI – 625020

APRIL – 2015

CERTIFICATE

This is to certify that this dissertation titled "**A PROSPECTIVE STUDY OF OPEN PREPERITONEAL VERSUS ANTERIOR APPROACH FOR RECURRENT INGUINAL HERNIA" at Government Rajaji Hospital, Madurai** submitted by **DR. P.NEGINE PAUL,** to the faculty of General Surgery, **The Tamilnadu Dr. M.G.R. Medical University, Chennai** in partial fulfillment of the requirement for the award of MS degree (Branch I) General Surgery, is a bonafide research work carried out by him under my direct supervision and guidance from September 2013 to August 2014.

Prof. Dr. S. LAKSHMI, M.S., D.G.O.,
Professor and Unit Chief,
Department of Surgery,
Madurai Medical College,
Madurai.

Place: Madurai

Date:

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I have great pleasure in forwarding it to **The Tamilnadu Dr. M.G.R. Medical University, Chennai.**

Prof. Dr. A. SANKARAMAHALINGAM, M.S.,

Professor and Head,

Department of Surgery,

Madurai Medical College,

Madurai.

Place: Madurai

Date:

DECLARATION BY THE CANDIDATE

I, **DR. P. NEGINE PAUL,** solemnly declare that the dissertation titled " **A PROSPECTIVE STUDY OF OPEN PREPERITONEAL VERSUS ANTERIOR APPROACH FOR RECURRENT INGUINAL HERNIA"** is a bonafide and genuine research work carried out by me in the Department of General Surgery, Madurai Medical College, during the period of September 2013 to August 2014, under the guidance and supervision of **DR. S. LAKSHMI, M.S., D.G.O.**, Professor of Surgery, and overall guidance by **DR. A. SANKARAMAHALINGAM, M.S.,** Professor and Head, Department of Surgery, Madurai Medical College, Madurai. This is submitted to **The Tamilnadu Dr. M.G.R. Medical University, Chennai,** in partial fulfillment of the regulations for the award of MS degree (Branch I) General Surgery course on April 2015.

Place : Madurai **SIGNATURE**

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Date:

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Place: Madurai **DR. P. NEGINE PAUL**

Date:

LIST OF ABBREVIATIONS USED

AD	Anna domino: After Christ
BC	Before Christ
B.D	bis in die: Twice a day
mm	millimeter
cm	centimeter
COPD	Chronic Obstructive Pulmonary Disease
DM	Diabetes Mellitus
D.O.A.	Date of Admission
H/O	History of
I.M	Intra Muscular
I.P.No	In Patient number
Inj	Injection
I.V	Intra Venous
No	Number
p	Probability (Significance of difference)
USG	Ultrasonogram
TEP	Totally ExtraPeritoneal Repair
TAPP	Trans Abdominal PrePeritoneal Repair
POD	Post Operative Day

ABSTRACT

INTRODUCTION :

It was Nyhus and Stoppa who shed a new light in the management of inguinal hernia by showing to the world the appropriateness of preperitoneal repair. Though the laparoscopic approach which came as a ramification of preperitoneal approach is getting popular, Lichenstein's anterior approach is still the widely done open surgical method even for recurrent inguinal hernia. In case of recurrent inguinal hernia with previous anterior approach, re surgery with anterior approach may prove difficult due to dense scar tissue and lead to complications. In such cases the open preperitoneal approach may prove to be a safe and better alternative. This study is done to empirically verify the efficacy of open preperitoneal approach in recurrent inguinal hernia.

METHODS :

A comparative study was done between 15 cases of anterior approach and 15 cases of preperitoneal approach for recurrent inguinal hernia in Govt. Rajaji hospital Madurai. Following parameters including Duration of procedure, Acute and Chronic pain, Per op complications, Post op complications including Seroma, Hematoma, Testicular atrophy and Duration of stay were compared. Results were submitted for statistical analysis and conclusions drawn.

RESULTS :

Open preperitoneal approach is better than anterior approach in terms of duration of procedure, acute and chronic pain, duration of stay, whereas no significant differences were made out with respect to per op complications and post op complications including seroma, hematoma and testicular atrophy.

CONCLUSION :

Despite the clear benefits, open preperitoneal approach is still not widely used which is in part due to its unfamiliarity. Open preperitoneal approach should be considered a valid option in the management of recurrent inguinal hernias.

KEY WORDS :

Recurrent inguinal hernia, preperitoneal, preperitoneal approach, anterior approach, seroma, hematoma, testicular atrophy, Nyhus, acute pain, chronic pain.

CONTENTS PAGES

INTRODUCTION

Inguinal hernia is one of the cornerstones of a general surgery practice. The treatment of inguinal hernia is integral to the history and current status of general surgery. Despite the frequency of the procedure, no surgeon has ideal results and complications such as postoperative pain, nerve injury, infection, and recurrence continue to challenge surgeons.[1] Hence there has been an evolution in different approaches for hernia treatment. The most significant advances to impact inguinal hernia repair have been the addition of prosthetic materials to conventional repairs and the introduction of laparoscopy. Lichenstein tension free mesh repair (anterior approach) is still the most widely done hernia surgery in India. However in case of recurrent inguinal hernias, anterior approach is difficult due to fibrous tissue, distorted tissue plains and anatomy. The advantage in the preperitoneal approach is that the hernia can be approached through a virgin tissue plane without fibrous tissue and the prosthesis can be placed between hernia contents and hernia defect. The strength of the transversalis fascia is reinforced by addition of prosthesis deep to it. Laparoscopic hernia repair which approaches the hernia through a preperitoneal approach is

increasingly becoming popular but it has the disadvantage of having a long learning curve, where dissection becomes demanding in case of large hernias and also high cost associated with the procedure. Transinguinal open preperitoneal approach avoids all the above disadvantages while retaining the advantages of preperitoneal mesh repair. The present study is aimed at reviewing the effectiveness of preperitoneal mesh repair in recurrent inguinal hernia.

AIM AND OBJECTIVES OF THE STUDY

AIM :

To study the effectiveness of open preperitoneal mesh repair in patients with Recurrent Inguinal Hernia .

OBJECTIVES :

To study open preperitoneal mesh repair versus anterior approach in recurrent inguinal hernia with respect to following outcomes

1. Duration of the Procedure
2. Postoperative Pain
3. Complications Per operative & Postoperative
4. Postoperative Duration of Hospitalization

REVIEW OF LITERATURE

HISTORICAL PERSPECTIVE

Though the management of hernias appeared relatively late in medical literature, today the repair of inguinal hernia is the most widely performed general surgical procedure all over the world.

The Ebers papyrus (1550 BC) has the earliest mention of inguinal hernia in which it, the pre-Homeric Egyptian physicians treated inguinal hernia conservatively. Celsus, a Roman (25 BC to AD 50) gives the first description of surgery for inguinal hernia.

During the nineteenth century (1837), Velpeau advocated injection of Iodine into the hernial sac.

The period of aseptic surgery began with Joseph Lister, who in 1867 gave his first paper on carrying out an operation under antiseptic conditions by the use of carbolic acid spray. This was a milestone in the surgical treatment of inguinal hernia[2.]

Three revolutionary discoveries made possible the development of safe hernia surgery. The first was the discovery of general anaesthesia. In 1846 William Morton of Boston publicly administered Ether as general anaesthetic in an operation performed in the

Massachussets General Hospital for the removal of a benign tumour of the left side of the neck in a young man by Joseph Warren. Second was the discovery by Joseph Lister the chemist, who discovered living micro organisms as the cause of infections, the germ theory in 1860. Lister's 'principles of antisepsis and asepsis in the care of wounds' was the next revolutionary discovery which brought the use of carbol spray in operative rooms.

In 1881, Lucas Championniere opened the inguinal canal for the first time. This was a major advancement in surgery of hernia.[2]

However the modern era of hernia surgery was ushered in by Edoardo Bassini (1844-1924). His repair being founded on basic anatomical principles changed the results of hernia surgery dramatically and revolutionised the field of herniology. For this reason he is hailed as the Father of modern herniorraphy.

His repair included the following

1. Splitting of external oblique aponeurosis.
2. Division of cremaster muscle.
3. Splitting the posterior wall.
4. Indirect sac resection.

5. Recontruction of posterior wall where the inguinal ligament is sutured to transversalis fascia, transverses abdominis, internal oblique and lateral border of rectus abdominis.

In 1887, Bassini first published his series of 262 cases in an Italian journal with only 7 recurrences over a period of 4.5 years.[3]

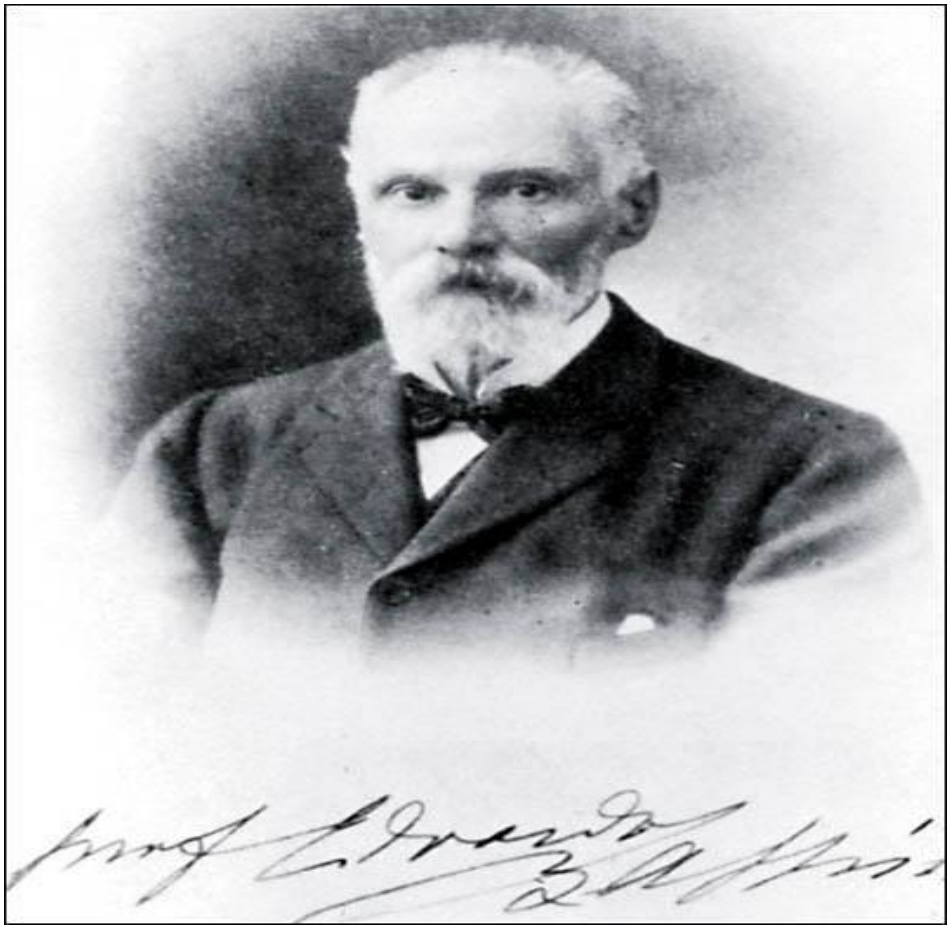


Figure 1 : Edoardo Bassini

THE BASSINI VARIANTS :

As the understanding of groin anatomy became more clear several modifications of Bassini's repair ensued trying to improve the original repair.

1. Halsted (I) Operation :

   Conjoint tendon sutured to inguinal ligament, external oblique closed above leaving cord in superficial subcutaneous plane. The procedure had unacceptable rate of testicular atrophy and infarction.

2. Ferguson Operation :

   Internal ring narrowed by sutures. Internal oblique and transveralis muscles were sutured to inguinal ligament. He differed from Halsted by closing the external ring above the cord. In his words, " Leave the cord alone for it is the sacred highway along which travel vital elements indispensable to the perpetuity of our race"[4] .

3. Andrews Operation :

   Upper flap of external oblique buttressed to inguinal ligament. Lower flap of external oblique sutured to anterior surface of upper flap to cover the cord.

4. Halsted (II) :

   Combined the procedures of Andrews and Ferguson.

5. Nylon Darning :

   It was introduced in 1918 by Handley. After completing the usual procedures of hernia surgery, Nylon sutures are repeatedly passed between the sutured posterior wall to create a weave.

6. Wolfer's Relaxing incision :

   Hockey stick incision made over anterior rectus sheath to rectus muscle to relieve excessive tension.

7. The Shouldice repair :

   Superb results are produced by Shouldice surgeons working in Shouldice clinic. The hospital and Shouldice repair procedure revolves around following principles listed below.

   a. Weight control
   b. Local anaesthesia
   c. Early ambulation
   d. Ligation of hernial sac
   e. Incision of Transversalis fascia
   f. Reconstruction of internal ring
   g. Resection of medial and lateral leaves of cremaster
   h. Search for multiple hernias

i. Stainless steel suturing
j. Continuous suturing (Seals fascial edges better, distributes tension equally)
k. Four suture lines.

So many other modifications of Bassini's initial work came into existence in subsequent years which made Attilio Catterina a celebrated student of Bassini to publish a textbook on the Original Surgery of Bassini.

So many years have ensued since Bassini originally described his procedure, but still his original procedure remains tall among all other tissue repair procedures. The biggest accolade was given to him by his contemporary Halsted near the end of his life, " I have not seen a single paper since Bassini's which contributed anything new. Prior to Bassini's publications, inguinal hernia had rarely been cured "[5].

But all the tissue repairs including Bassini and shouldice concentrated on only one side of the coin. They concentrated on preventing hernia recurrence leaving patients postoperative comfort to secondary. The strong posterior layer they created along with strong external oblique aponeurosis with the cord trapped in between them

resulted in cord compression. The post operative complaints were that of chronic pain, testicular atrophy, dysejaculation and problems with fertility.

To prevent tension in suture lines in tissue repairs, surgeons started experimenting with various prosthetic materials for tensionless repair. They found it hard to overcome the triple obstacles in their way namely infection, rejection and ultimately recurrence.[6]

The first use of mesh in repair was by McGavin in 1909.

Silver wire meshes were used in most of the cases. They corroded, fragmented under stress fractures and were rejected through chronic sinuses and lead to recurrence. Burke used tantalum sheets, Mayr used skin graft without much use.

The development in the field of prosthesis was brought about by Usher in the year 1962. Francis Usher used polypropylene material in the name of Malex mesh for cases which were technically challenging. These meshes when used in uncontaminated groin hernias provided great results overcoming objections and challenges. However while Usher was not in favour of using mesh for simple cases, Lichenstein advocated mesh for all cases, his view being heavily criticised at that time.

Those surgeons who used prostheses mesh at that time reserved it for large direct, large sliding or recurrent inguinal hernias. Fear of infection dominated their views, which meant that they were reluctant to use it unless absolutely necessary.[7]

But time proved Lichenstein to be right. The long term results of the Lichtenstein technique have been reported over the last 10 years and in several recent series of over 10,000 cases, have shown recurrence rates of 0.2% and the infection rates of 0.03%.[8]

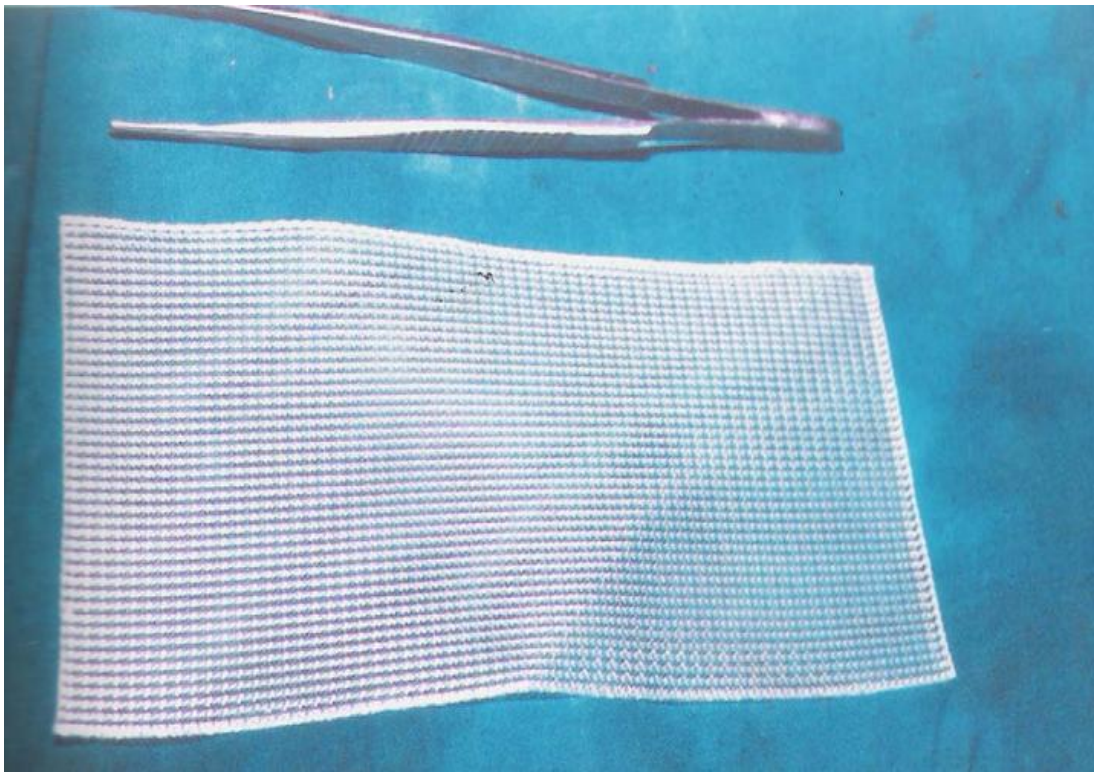


Figure 2 : Polypropylene Mesh

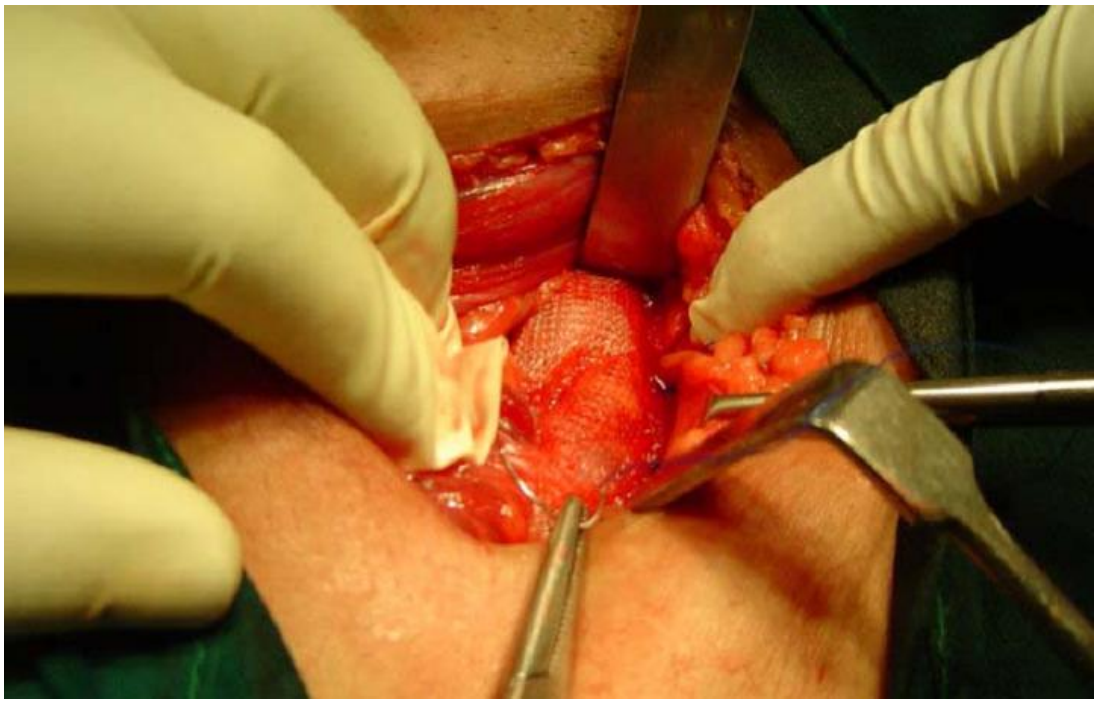


Figure 3 : Lichenstein’s Repair

LAPAROSCOPIC MESH REPAIR :

The era of laparoscopic hernia repair began when Ger et al. closed the peritoneal opening of hernial sac under laparoscopic guidance. Schultz introduced laparoscopic herniorraphy. Phillips et al. developed Totally extraperitoneal prosthetic technique (TEPP) while Arregui published Trans Abdominal Preperitoneal prosthetic approach(TAPP). Intraperitoneal onlay mesh was introduced by Fitzgibbons.

HISTORY OF PREPERITONEAL MESH REPAIR :

Annandale of Edinburg in 1886 introduced preperitoneal mesh repair. Cheatle (1920) used a vertical incision, retracted Rectus laterally, entered preperitoneal space of Retzius and completed hernia repair. The breakthrough in preperitoneal approach came when McEvedy introduced a surgery for Femoral hernia. He used an oblique incision on Rectus sheath and retracted Rectus medially rather than laterally. The skin incision was changed to half a Pfannenstiel incision by Reay Young. Nyhus and his disciples propagated the safety, efficacy and reliability of this repair. They claim zero cases of incisional hernia in over 4000 cases they performed. Wantz modified the procedure by using a huge mesh.

Another revolution came through a French Surgeon named Fruchard when he described the myopectineal orifice named after him. It is bounded by Rectus abdominis medially, iliopsoas laterally, internal oblique superiorly and iliac bone inferiorly. This myopectineal orifice is the site of all groin herniation.

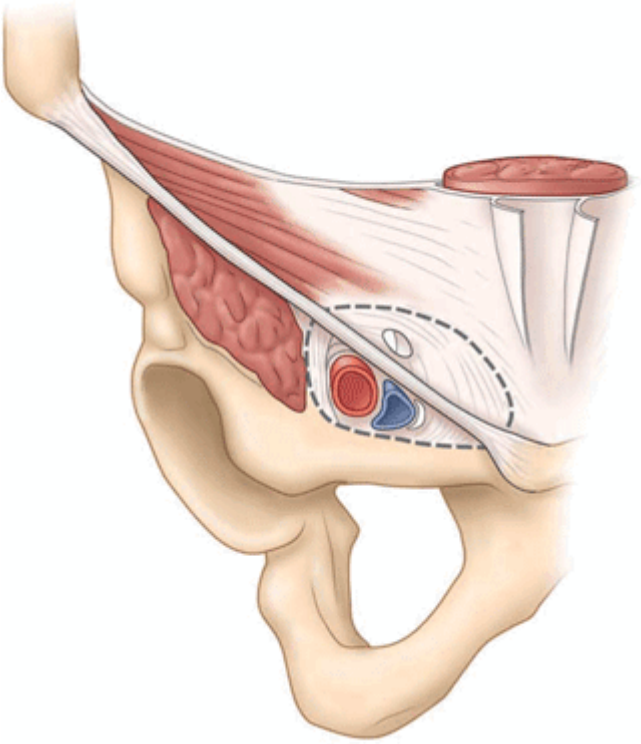


Figure 4 : Myopectineal Orifice of Fruchard

Modern surgery strives to strengthen this orifice thereby negating any possibility of hernia occurrence. Fruchard's pupils Rives and Stoppa took his vision and spearheaded the preperitoneal approach campaign developing and popularising procedures of their own.

EMBRYOLOGY

There is no doubt, that the first appearance of the mammal, with his unexplained need to push his testicles out of their proper home in to the air made a mess of the three layered abdominal wall that had done the reptiles well, for millions of years.[9] In a highly synergistic way the skin, the parietal peritoneum and the embryologic and anatomic entities between them, produce the future pathway for the testis. The skin will form the scrotum in males and labia in females. The embryological entities between the skin and the peritoneum, permit the processus vaginalis to penetrate them and to form the inguinal canal. The downward journey of the testis to the scrotum is thus allowed but, the descent of the ovary outside the peritoneal cavity is forbidden.[10]

Inguinal Region

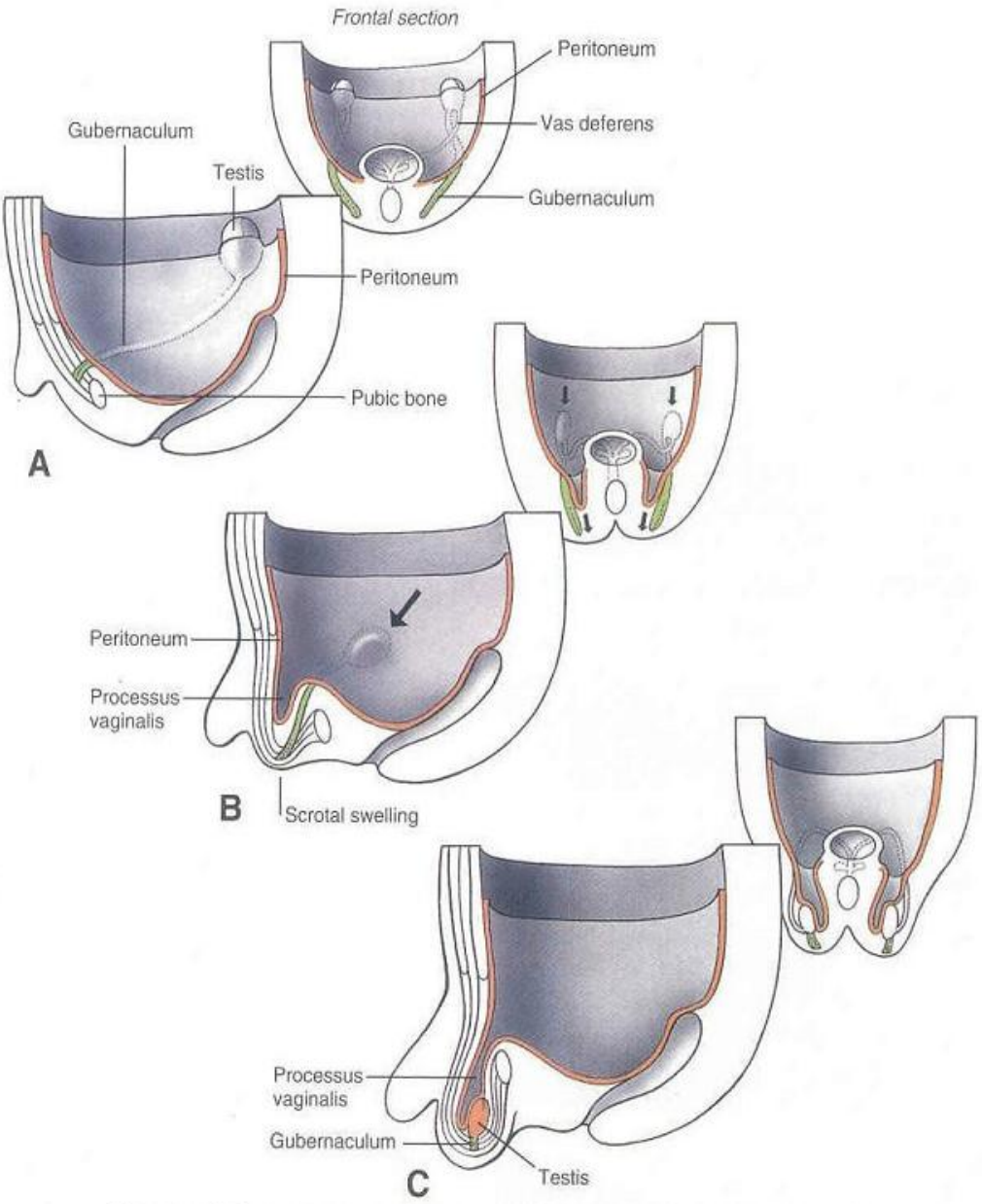
The testis originally lies on the posterior wall of the abdomen, at the level of the upper lumbar vertebrae on the medial side of the mesonephros, near the lower pole of the mesonephros by a peritoneal fold, called mesorchium. The descent or migration of testis in to its corresponding scrotal chamber is accomplished by following the lead of the fibromuscular band - gubernaculums testis. It arises mainly within a peritoneal fold called the plica inguinalis, which stretches from the

inguinal region to the lower end of the mesonephros. The gubernaculum attains greatest development about the sixth month, when it becomes a stout thick cord and is attached, above to the lower end of the testis and below it pierces through the abdominal wall, in its passage to the bottom of the scrotal pouch, there by forming the inguinal canal. Along with it, a process of peritoneum the processus vaginalis descends in to the scrotum, dragging withit thin fascial prolongations of the layers of the abdominal wall. Thus, the processus vaginalis receives coverings from the aponeurosis of the external oblique and internal oblique muscles and from fascia transversalis. As the passage through the abdominal wall occurs, the testis and cord structures are surrounded by vestiges of the external oblique (external spermatic), internal oblique (cremasteric fascia and muscle) and transversalis fascia (internal spermatic).The testicle appears during the first month of intrauterine life, as a swelling at the caudal end of the genital ridge. It enlarges rapidly and by the 6th week has a mesentery and bulges in to, but remains behind the peritoneum. In the second month, the testis begins to descend and by the third month it migrates to the iliac fossa and lies near the brim of the true pelvis. By the beginning of the seventh month it reaches the deep inguinal ring. It traverses the inguinal canal during the seventh month, reaching the superficial inguinal ring at the eighth month and finally

reaches the bottom of the scrotum about the end of ninth month. The ovarian descent normally ceases after 12th week at the area of the pelvic brim. The blind extremity of the processus vaginalis gets invaginated in the form of a cup for the reception of the descending testis. As the migration of the testis proceeds, the gubernaculum shortens and eventually atrophies, but some trace of the gubernaculum persists at the bottom of the scrotum below tunica vaginalis. The shortened remains of the gubernaculum form the scrotal ligament, fixing the testis to the bottom of the scrotal pouch.

By the end of the eighth month, the cavity of the upper part of the processus vaginalis disappears and its peritoneal wall forms a fibrous cord. The lower part of the processus vaginalis is thus entirely cut off from the general peritoneal cavity and consists of two layers, the parietal portion of tunica vaginalis lining the scrotum and the visceral portion of the membrane is applied on to the surface of the testis. In female, the gubernaculum extends from the lower poles of the ovaries to the labium major through the inguinal canal. The upper part of the gubernaculum contracts adhesions with the sides of the fused para mesonephric duct and is thus represented by the ligament of the ovary, while the lower part which is developed within the plica inguinalis is represented by the round ligament of the uterus, extending from the side of uterus to the

labium major. A pouch of peritoneum, called the canal of Nuck, similar to the processus vaginalis in the male, accompanies the gubernaculum along the inguinal canal in to the labium major. This is normally obliterated well before birth. The occasional persistence of the vaginal process after birth serves as the genesis of induction of inguinal hernia in the female.



Descent of the testes. *A–C*, Between seventh week and birth, shortening of the gubernaculum testis causes the testes to descend from the 10th thoracic level into the scrotum. The testes pass through the inguinal canal in the anterior abdominal wall.

Figure 5 : Embryology of Testicular descent

ANATOMY

No disease of the human body belonging to the province of surgeon requires in its treatment, a better combination of accurate anatomical knowledge with surgical skill than hernia, in all its varieties.

- Sir Astley Patson Cooper, (1804)

The groin is that portion of the anterior abdominal wall below the level of anterior superior iliac spines. For proper orientation, the groin is referred to as the surgeon views the patient on the operating table. The pubis and superior pubic(Cooper's) ligament are medial. The epigastric vessels and transversalis fascia condensation at the internal ring are lateral. The anterior femoral sheath, iliopublic tract and inguinal ligament are inferior and the transverses abdominis aponeurosis and its arch are superior. Skin Langer's lines are transverse in the groin with convexity facing downwards. The anterior superior spine of ileum is easily palpable in the lateral groin and Public tubercle on the lateral margin of the pubis. Spermatic cord is identified as it exits from the external ring which overlies the lateral aspect of the pubic tubercle. The deep ring is located approximately 2 cm above the skin crease between the thigh and the abdomen and midway between anterior superior iliac

spine and pubic symphysis. The skin of groin is innervated by the ilioinguinal, iliohypogastric and genital branch of genitofemoral nerves.

Subcutaneous Tissues Of Groin :

Divided into two strata –

superficial fatty layer (Camper's fascia) and deeper membranous layer (Scarpa's fascia), which continues into perineum as the Colle’s fascia.

Innominate Fascia :

This is a well defined layer that covers the external oblique aponeurosis and the inguinal ligament. Each of the abdominal wall muscle has an identifiable fascial envelope. But continuation of this diaphanous fascial investment in to tendons and aponeurosis is not easily distinguished. It binds down the free lower edge of the inguinal ligament to thigh and continues as the fascia lata.

External Oblique Muscle and Aponeurosis :

It is curved round the lateral and anterior parts of the abdomen and is the largest and most superficial of the three flat muscle of the groin. It arises from the lower 8 ribs (5 to 12) and its fibers are directed downwards, forwards, and medially. Above, the aponeurosis

interdigitates with the serratus anterior muscle and continues as a sheet of fascia over both the muscles. The most posterior fibers run vertically downwards and insert into the anterior half of iliac crest. Between the last ribs and iliac crest, a free border forms the lateral boundary of lumbar triangle. From the anterior superior iliac spine to the pubic spine, the aponeurosis forms a free border which is called inguinal ligament. The muscle becomes totally aponeurotic in the groin with its fibers running obliquely downwards. It becomes the external layer of the anterior rectus sheath and further inserts on the pubis. The superficial inguinal ring is a triangular opening in the external oblique aponeurosis, 1 to 1.5 cm lateral to the pubic tubercle. The opening is formed by the splitting of external oblique.

Internal Oblique Muscle and Aponeurosis :

The internal abdominal oblique muscle lies between the external oblique and the transverses abdominis muscles. This fan shaped muscle has a narrow origin and a broad insertion. It originates from the outer half of the inguinal ligament, from the intermediate line on the iliac crests and from the posterior lamella of the lumbodorsal fascia through which it gains attachment to the lumbar spines. The uppermost fibers run almost vertically upward and are inserted into the lower 4 ribs and

their cartilages. The intermediate fibers form an aponeurosis which divides above the semi circular line of Douglas into 2 lamellae at the lateral border of the rectus muscle. The anterior lamella accompanies the external oblique aponeurosis to form the anterior rectus sheath and the posterior lamella accompanies the aponeurosis of the transverses abdominis to form the posterior rectus sheath. Below the semicircular line, the combined aponeurosis of all 3 lateral abdominal muscles fuse and pass in front of the rectus muscle as the anterior rectus sheath. Those fibers which originate from the inguinal arch, above the spermatic cord in the male and the round ligament in the female become tendinous. They insert conjointly with those of the transverses abdominis into the crest of the pubis. It is this fusion of the tendinous portions of the internal oblique and transverses muscles that results in the structure known as the conjoined tendon.

Transverses Abdominis Muscle and Aponeurosis :

This is the most internal of the three flat muscles of the abdominal wall. The muscle arises from the iliopsoas fascia, from the inner lip of the anterior 2/3rd of the iliac crest, the lumbodorsal fascia between the iliac crest and 12th rib and from the inner surfaces of the cartilages of the lower 6 ribs where it interdigitates with the diaphragm. It passes

medially in a transverse manner around the lateral aspect of the abdomen on to the anterior abdominal wall. This is the key layer, because of its role in hernia repair. The general layer of the muscle (lateral portion) and the aponeurosis (medial portion) is towards the linea alba, where it forms the anterior rectus sheath below the semi circular line of Douglas. In the groin it can be divided into continuous and discontinuous portions. The continuous portion is the extension of the main muscle and aponeurosis, the lower border of which arches above and medial to cord structures and are called Transverses abdominis arch, which in 10% of cases due to its dense nature and insertion into the pubic tubercle and the crest is called falx inguinalis. In 3% of cases the falx receives contribution from the internal oblique aponeurosis also thereby forming the conjoined tendon. The discontinuous portion lies below the transverses arch, forms the posterior wall of the inguinal canal, medial to the internal ring. One fourth of these fibers show marked individual variations and most often is deficient, represented only by the transversalis fascia, thereby forming a critical weak spot in the posterior wall of the inguinal canal. The inferior most edge of this layer is formed by the "iliopubic tract", a collection of aponeurotic fibers. This tract arises laterally from the inner lip of the iliac crest, the anterior superior iliac spine and the iliopectineal

arch. The fibers traverse medially, separating away from the inguinal ligament and present beneath the deep inguinal ring. This ligament forms at least one border of defect in an indirect, direct or femoral hernia and hence is suited for the repair of any these hernias.

Transversalis Fascia :

This is a portion of the endo-abdominal fascia that encloses the abdominal cavity and peritoneum. The portion which invests the transverses muscle and aponeurosis is called Transversalis fascia. It is continuous with the lumbar, iliac, psoas, obturator and rectus fascia. It is adherent to the transverses muscle - aponeurosis due to the numerous slips of fibrous tissue that traverse the muscle and attach to the deep inter parietal fascia. Hence, practically it forms part of the transverses muscle aponeurosis fascia complex. At the deep inguinal ring there is a tubular projection of this fascia – internal spermatic fascia that extends outwards in a blunt funnel like fashion to cover the ductus deferens and the spermatic vessels. However, the blunt funnel is not perfectly conical, but is skewed and the axis of the funnel is less oblique than the axis of the vessels through the deep inguinal ring. The redundant transversalis fascia in the medial side of the deep ring is called 'Transversalis fascia sling'. The transversalis fascia is somewhat like the letter ‘V’ with the

open end pointing supero laterally to the groin and the diverging ends are called crurae. The superior crus is the longer one, having an extensive attachment above the deep ring, through the interdigitating facial slips. The shorter inferior crus runs parallel with and very slightly above the iliopubic tract. Most often, the posterior inguinal wall is represented only by this fascia and leads to weak spot in the groin.

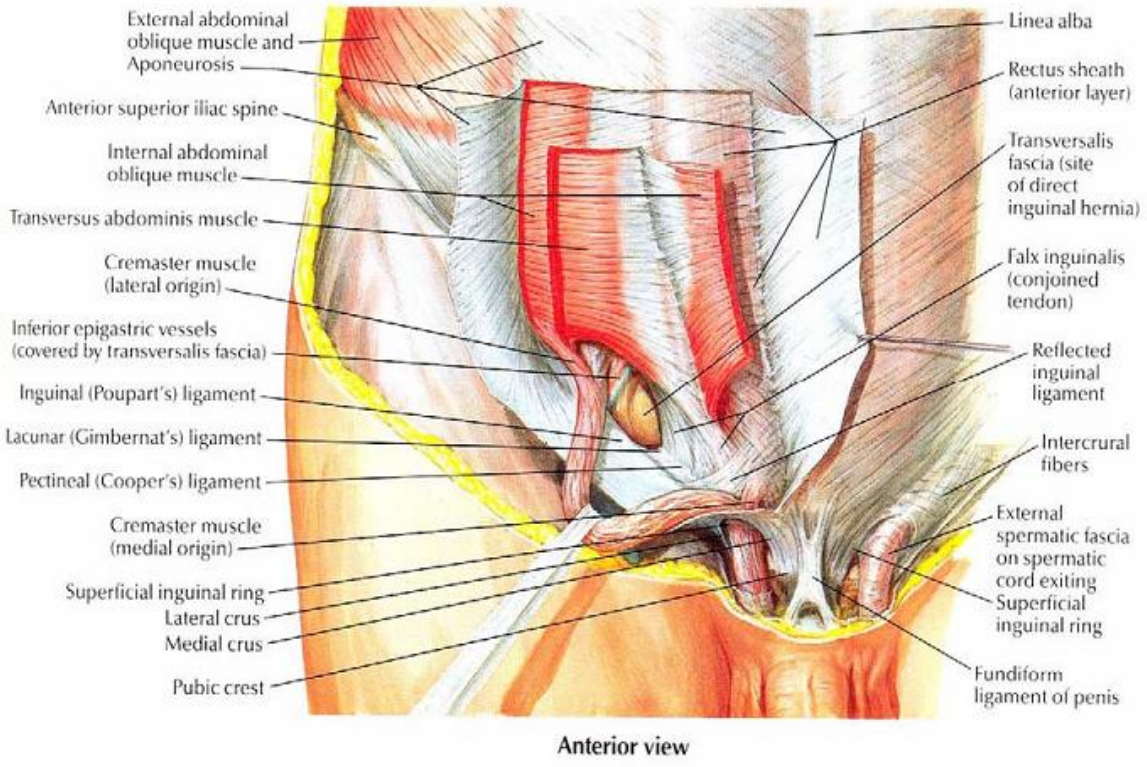


Figure 6 : Anatomy of Inguinal region

Rectus Sheath :

The posterior rectus sheath is lacking in any tendinous structure from the semicircular line to the pubis. Above this point, which is located midway between the umbilicus and the pubis, aponeurotic fibrous sheath from the transverses and internal oblique muscles reinforce the posterior sheath. In the groin aponeurosis of all the three flat muscles contribute to the anterior sheath.

Peritoneum :

In the groin as elsewhere, the peritoneum is a thin elastic membrane that serves only to provide a lubricating surface for its contained viscera. Because of the elastic character of the peritoneum it does not act in the prevention of hernia.

The Conjoint Tendon (Falx Inguinalis) :

The transverse fibers of the transverses muscle proceed to their insertion in the rectus sheath and the linea alba, while the lower fibers course downward medially and caudally, sometimes to fuse with fibers of internal oblique as they insert into the anterior pubis and iliopectional line. Only when the aponeurosis of the transverses and the internal oblique are fused some distance lateral to the rectus sheath, the term

conjoined tendon is used. This anatomic configuration however, is rare. The transverses muscle contributes 80%of the conjoint tendon. The conjoint tendon lies lateral to the rectus muscle and immediately deep to the superficial inguinal ring. It passes down to its insertion deep to the inguinal and lacunar ligaments. The spermatic cord or round ligament of uterus lies anterior to it while passing through the superficial inguinal ring. The conjoint tendon has a very variable structure and in 20% of the subjects it does not exist as a discrete anatomic structure - it may be absent or slightly developed or it may be replaced by a lateral extension of the tendon or original ring, so that no interval is present between the lower border of the transverses and the inguinal ligament. An inguinal hernia is repaired using the transverses abdominis aponeurosis, the transversalis fascia and the lateral edge of the rectus sheath. On occasion the internal oblique muscle, the internal oblique aponeurosis, ligament of Henle, the interfoveolar ligament of the reflected inguinal ligament may also be used in the repair. Although none of these really are conjoint, there is a tendency to use the term "conjoined tendon" for any mass of fascia or aponeurosis from the internal oblique or the transverses abdominis muscles. As the arch of the transverses abdominis muscle approaches the rectus sheath, it becomes less muscular and more aponeurotic(transverses aponeurosis). Close to the internal ring, it is

covered by the much more muscular arch of the internal oblique muscle, but it is rarely covered in the lower medial portion of the inguinal region. In the inguinal region, the internal oblique is always muscular, whereas the transverses abdominis is aponeurotic. The reflected inguinal ligament is composed of aponeurotic fibers from the inferior crus of the external inguinal ring reaching medially upward towards the linea alba. John E.Skandalakis et al (1993)[11], state that

1. The conjoined tendon rarely exists

2. The distinction between the ligament of Henle and conjoined tendon is on of anatomic nicety and of little practical significance, provided the distinction is recognized.

3. The term "conjoined area" may be applied correctly to the region which covers the ligament of Henle, the transverses abdominis aponeurosis, the inferomedial fibers of the internal oblique (musculature or aponeurosis), the reflected inguinal ligament and the lateral border of the rectus tendon and sheath.

Cooper’s Ligament (Iliopectineal Ligament) :

Cooper's ligament is remarkably constant in form and extent and represents the strongly reinforced periosteum of the superior ramus of

the pubis. On the superior and internal aspect of superior pubic ramus, covering and immediately internal to the pectineal line, the periosteum is supplemented by a considerable quantity of dense fibrous tissue so that it usually becomes 2 cm or even 3 cm thick. The fibers are adherent to and directed parallel to the superior ramus of the pubis. This fibrous reinforcement gradually fades away near midline on the internal surface of body of pubis. Laterally, it continues posteriorly along the brim of the true pelvis, Becoming progressively thinner until it can no longer be distinguished from periosteum of ileum. Cooper's ligament is particularly important in the surgical correction of femoral hernias and large direct inguinal hernias, because it forms a solid anchor along the inferior or posterior aspect of these hernia defects, through which sutures may be placed with confidence that they will hold.

Inguinal Ligament (Ligament of Poupart) :

It is the lower, thickened portion of external oblique aponeurosis extending from the anterior superior iliac spine to the pubic tubercle. Its edge is rolled inwards to form a gutter. The lower edge of the inguinal ligament is loosely bound to the fascia lata by the Innominate fascia. This fascia also serves to bind together the collagenous fibers of aponeurosis and inguinal ligament. Medially, the

inguinal ligament gets inserted on the pubic tubercle and fans downward to the superior pubic ramus as the lacunar ligament. The medial attachment of the inguinal ligament is continuous with the insertion of the aponeurosis into the linea alba.

Lacunar Ligament of Gimbernat :

The ligament of Gimbernat isa triangular fascial extension of the inguinal ligament, before its insertion to the pubic tubercle. It is inserted at the pecten pubis and its lateral end meets the proximal end of the ligament of Cooper. It serves to broaden the attachment area for the inguinal ligament by fanning. Condon asserts that, “it never forms the medial border of the normal femoral canal”. Other investigators however, hold the opposite view.

The Cremaster Muscle :

The cremaster consists of a number of loosely arranged muscle fascicule lying along the spermatic cord. They are united by areolar tissue to form the saclike cremasteric fascia around the cord and testis, within the external spermatic fascia. The lateral part of the muscle, arising from the inguinal ligament, has been variously described as in continuity with the medial edge of the internal oblique, deep to the internal oblique extending as far as the anterior superior iliac spine and

in continuity with either the internal oblique or transverses or as a pointed tendon from the middle of the inguinal ligament piercing the internal oblique near its medial margin. The fibers pass along the lateral aspect of the spermatic cord through the superficial inguinal ring and then spread out into the fasciculi in loops, of increasing length along its anterolateral aspect. The shortest and the most superior fasciculi turn inwards in front of the cord to join the medial part, while the longer fasciculi gain attachment to the fascia over the cord and upper part of the tunica vaginalis. The medial part of the muscle is variably developed and maybe absent. It arises from the pubic tubercle and possibly from the pubic crest, falx inguinalis and lower border of transverses. Its fasciculi, loop on the posteromedial aspect of the cord, interlacing with those of the lateral part. The whole muscle maybe described as forming continuous loops from the middle of the inguinal ligament as far as the tunica vaginalis and returning to be attached to the pubic tubercle. In the female, a few fibers descending on the round ligament of the uterus represent the lateral part of the cremaster. The cremaster pulls up the testis towards the superficial inguinal ring and thus plays an essential role in testicular thermoregulation.

Inguinal Canal :

It begins at the site of emergence of the spermatic cord through the transverses aponeurosis (internal ring) and ends at the pubic tubercle. It is oblique and 3.75 cm long, slanting downwards and medially, parallel with and a little above the inguinal ligament. It extends from the deep to the superficial inguinal ring. The boundaries are:

Anteriorly: Throughout by the skin, superficial fascia, external oblique aponeurosis, in its lateral one third by the muscular fibers of the internal oblique.

Posteriorly: The transversalis fascia, reinforced medially by the falx inguinalis (when present).

Superiorly: The arched fibers of internal oblique and transverses aponeurosis.

Inferiorly: The inguinal ligaments and it continuation, lacunar ligament.

Hesselbach's Triangle :

It is bounded medially by the lateral border of the rectus sheath, laterally by the inferior epigastric vessels and below by the inguinal ligament. Now, these boundaries have to be redefined to include only those

structures that are in contact with the posterior inguinal wall in the same plane. Redefined boundaries are: Rectus sheath with or without falx inguinalis, inferior epigastric vessels and iliopubic tract and Cooper's ligament.

Structures passing through the inguinal canal;

Spermatic cord: Originates at the deep ring and consists of

a. Arteries: Testicular, cremasteric and artery to vas.

b. Veins: Corresponding veins, mainly testicular (pampiniform plexus).

c. Nerves: Genital branch of genitofemoral nerve, cremasteric nerve,

Sympathetic plexus derived from Para aortic and pelvic plexus.

d. Lymphatics of the testis.

e. Vas deferens and areolar connective tissue.

Coverings of the spermatic cord from within: Are processus vaginalis, internal spermatic fascia (Transversalis fascia), cremasteric fascia (Internal oblique muscle and fascia) and external spermatic fascia(External oblique muscle and fascia).

Blood Vessels and Nerves :

The external iliac artery gives off two major branches, before crossing beneath Poupart's ligament, where it becomes the femoral artery. These tributaries, the deep circumflex iliac and the inferior epigastric vessels, are not vital. The latter, serves as the medial border of the deep ring, or the lateral border of the direct triangle. Its course can be followed topographically by an imaginary line connecting a point midway between the umbilicus and the pubis. There is, therefore an additional method of identifying the position of the internal ring. The epigastric artery gives off two branches, the cremasteric and the pubic. The cremasteric vessel exits along the medial aspect of the deep inguinal ring and originally must be the sacrificed artery. The pubic branch is originally quite small and lies on the iliopubic tract, proceeding medially and then downward to join the obturator artery, rising from the hypogastric vessels. The testicular artery arises directly from the aorta to supply the testis. The spermatic cord contains still one other small vessel, the umbilical artery, to supply the ductus deferens. Clear visualization of pubic veins following the course of artery is essential to avoid troublesome bleeding during the repair of direct or femoral hernias. The muscles of the abdominal wall are innervated by the lower six thoracic and first lumbar nerves. The essential nerves of the groin are

the ilioinguinal, the iliohypogastric and the genitofemoral. The last, arising from L1 and L2 supplies the cremaster muscle, the skin of the scrotum and the medial aspect of the thigh. Its integrity is essential to the cremaster reflex, but frequently during herniorrhaphy it is inadvertently divided as it passes medially on the posterior aspect of the spermatic cord to emerge through the superficial inguinal ring. The ilioinguinal and iliohypogastric nerves arise primarily from L1. Just medial to the anterior superior spine these nerves traverse the internal oblique and come to lie beneath the external oblique aponeurosis. In this location, a nerve block can be readily performed. The hypogastric branch of the iliohypogastric is mainly a motor nerve that supplies the abdominal muscles along its course. It exits through the external oblique aponeurosis above the external ring. Care is necessary to avoid injury to the nerve when performing a relaxing incision.

Pre peritoneal space :

Pre peritoneal space is easily cleavable space situated between peritoneum and transversalis fascia. Perhaps the classic definition of preperitoneal space is correct but one accepts the bilaminar formation of transversalis fascia into anterior and posterior layers two spaces are formed one between anterior and posterior layers of transversalis fascia

and one between peritoneum and posterior layer. Clinically significant parts of preperitoneal space includes myopectineal orifice of Fruchaud, the prevesical space of Retzius , the space of Bogros and the retroperitoneal peri urinary space.

Myopectineal orifice of Fruchaud :

The myopectineal orifice is beneath the arching lower border of transversus abdominis and internal oblique muscle is bounded laterally by iliopsoas muscle and medially by lateral edge of rectus abdominis muscle and inferiorly by pubic pecten. Iliopubic tract and inguinal ligament divide it which separate inguinal outlet from femoral outlet . Myopectineal orifice represents the potentially weak area in abdominal wall that permits the inguinal and femoral hernias.

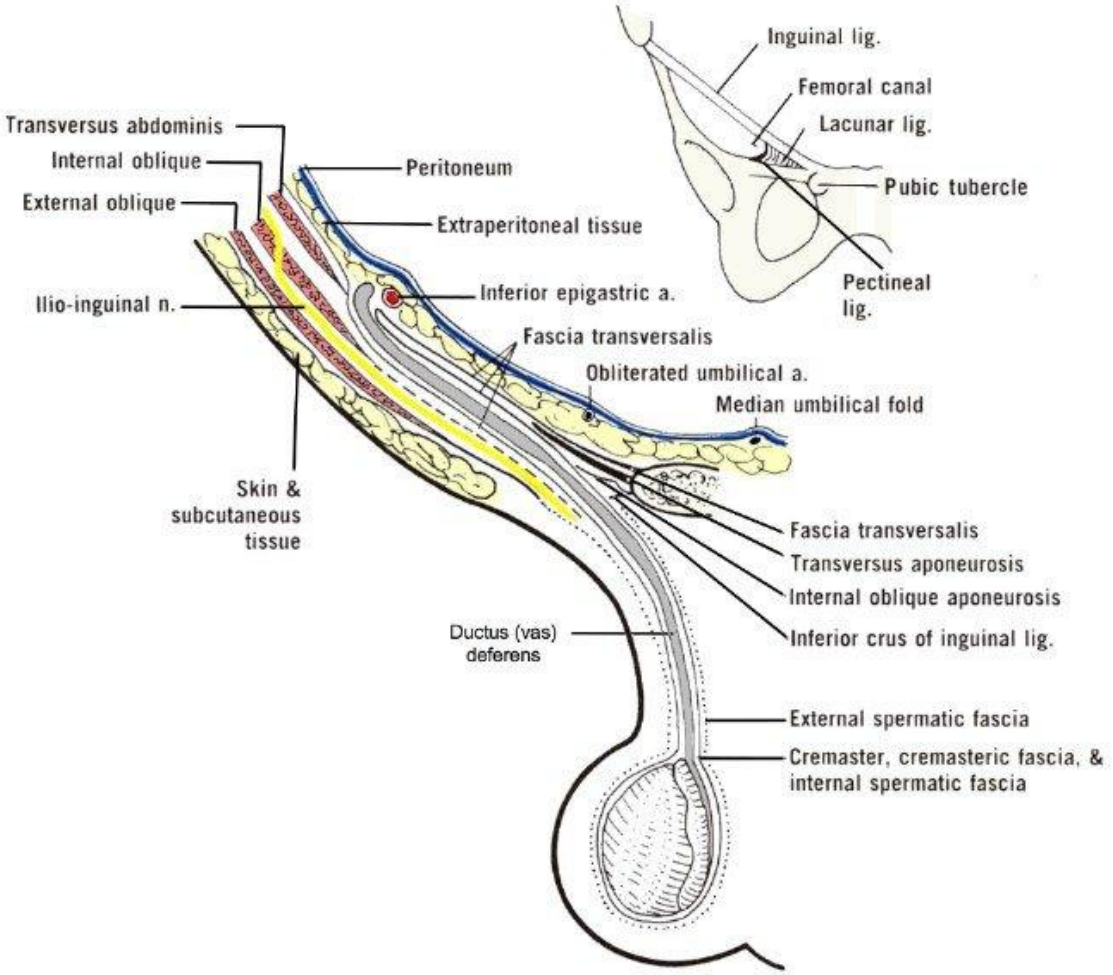


Figure 7 : Inguinal region Anatomy

Space of Retzius :

The space of Retzius extends from muscular floor of the pelvis to the level of the umbilicus. Anteriorly the bodies of the pelvic bones, medial portions of pubic rami and posterior lamina of rectus sheath bound it to the level of arcuate lines of douglas. In this pelvis the prevesical fascia and lateral pillars of bladder and the covering pelvic peritoneum bound the space posteriorly. More superiorly vesico

umbilical fascia and the peritoneum provide a posterior wall of the space. Space of Retzius is closed laterally along the line of fusion provided by inferior epigastric vessels and the tissue that encloses them.

Space of Bogros:

In 1983, Bogros described triangular space that is between peritoneum and abdominal wall that can be entered through inguinal incision. This space extends upwards in to retroperitoneal area and some workers state that it continues medially with space of Retzius but is separated by line of fusion along the inferior epigastric vessels.

Presence of easily cleavable spaces of Retzius and Bogros allow preperitoneal placement of mesh with minimal fixation as pioneered by Stoppa . It also makes laparoscopic surgery possible. Though there are no major structures pass through this space but the wall contain structures which have to be protected during dissection.

ETIOLOGY AND PATHOPHYSIOLOGY[12, 13]

The cause of hernia is multifactorial and it is assumed that the following factors are involved.

1. Evolution :

The absence of posterior rectus sheath below the arcuate line and only a rather substantial transversalis fascia unsupported by muscles or aponeurosis, resisting the intra-abdominal pressure and holding the breach between the abdomen and the thigh. It is compounded by humans having adopted the upright posture and change from quadrupedal to bipedal locomotion. Mammals that walk on four limbs have permanently patent processus vaginalis but do not develop hernia. The reason in these animals, the thigh is flexed forward. The groin structures are not stretched under tension and inguinal canal lies in an upward direction. The weight of abdominal contents is directed forward and downward, away from the inguinal region towards the anterior wall of the upper abdomen. So, inguinal canal is not subjected to significant gravitational stress. In man, the upright posture causes gravitational stress to pass down to the lower abdominal wall, which is structurally not designed for it nor has the evolution suited it for its new role. Further, the inguinal canal is directed downward and the weight of the

intra abdominal contents pressing on its internal opening tends to dilate it and allow the loops of bowel to enter the canal.

2. Congenital and Anatomical Factors

a. Patent Processus Vaginalis: Is the prime cause of indirect inguinal hernia in infants and children. The development of processus vaginalis, its migration and its final obliteration are intimately linked to the descent of the testis from the abdominal cavity into the scrotum. After the testis reaches its final destination, the lumen of the processus vaginalis is obliterated between the internal ring and the upper pole of the testis. The entire processus vaginalis may remain patent or only part of it, giving rise to indirect hernia, scrotal hydrocele, encysted hydrocele of cord or hydrocele of canal of Nuck, in females. The presence of patent processus vaginalis does not necessarily indicate that either hernia is present or one will necessarily develop in future. The incidence of patent processus vaginalis in adults who do not develop hernia during their life is up to 20%.

b. Subtle varieties in the attachment and arrangement of abdominal muscles.

c. Females are particularly free of direct inguinal hernia. The narrowness of the interval between the transverses arch and the inguinal

ligament and the hermetical attachment of external oblique aponeurosis are the important factors in protecting women against direct hernia. On the other hand, musculoaponeurotic attachments in woman are such that they frequently develop femoral hernia. Other factors that are significant in the etiology are the number of aponeurotic fibers in the transverses aponeurosis which determines the intrinsic strength of the layer. The disposition of the transverses arch in relation to the Iliopubic tract indirectly determines the size of the inguinal gap or defect in the Hesselbach's triangle.

d. The obliquity of the inguinal canal, which during sudden exertion increases the intraperitoneal pressure, compresses the anterior and posterior walls of the canal there by occluding the canal.

3. Shutter Mechanism :

In spite of increased intra abdominal pressure, the natural weak spots of the groin - the internal inguinal ring and the transversalis fascia maintain, their integrity in majority of the individuals and even in those with an open internal ring and patent processus vaginalis. The accepted explanation for this is the physiologic '"Shutter mechanism" which is activated, when the abdominal muscles contract to raise the intra abdominal pressure .As the internal oblique and transverse abdominis

muscles contract, their lower fibers forming the myoaponeurotic roof of the inguinal canal "the conjoined tendon", that arches over the spermatic cord also sharply contracts and as the fibers shorten, the arch straightens out and descends to come to lie close to or on the inguinal ligament and so covers and protects the fascia transversalis. The shutter also passes down in front of the internal ring and counteracts the pressure on the ring from inside the abdomen. Contraction of the transverses abdominis muscle also pulls up and tenses the crurae of the internal ring which make up the thickened bands of the iliopubic tract and fascia transversalis causing the ring to close like a sphincter snugly around the cord. At the same time, the external oblique muscle contracts its aponeurosis which forms the anterior wall of the inguinal canal, becomes tense and presses on the internal ring and on the weak posterior wall of the inguinal canal and so reinforces them by counter pressure against the intra abdominal forces that push outwards. The inguinal ligament is also pulled upwards by the same contraction to become convex clinically.

4. Raised Intra Abdominal Pressure :

When intra abdominal pressure is actively raised the shutter Mechanisms are automatically activated to counteract the increased

pressure and hernia does not occur. But when intra abdominal pressure rises passively and the abdominal muscles are relaxed, shutter mechanism is not activated, so fascia transversalis is left on its own to withstand the increased intra abdominal pressure. If patent processus vaginalis is present or if the fascia transversalis is not sufficiently strong enough to become attenuated by prolonged pressure and stretching, it gives way and hernia appears. This situation is seen in pregnancy, ascites due to cirrhosis, ventriculoperitoneal shunts and peritoneal dialysis. The balance between the resistance of the abdominal wall and the intra abdominal pressure may be upset even in a fit young man, who is suddenly called upon to lift an extremely heavy weight, which he is not accustomed to or trained to lift, immediately develops pain in the groin and hernia down to the scrotum.The abdominal wall "rupture" probably occurs in the presence of a patent processus vaginalis, the opening up of which, the counter mechanisms have resisted until the overwhelming increase in pressure has occurred.

5. Integrity of the Fascia Transversalis[14] :

The ability of the fascia transversalis to withstand physiologic and pathologic elevations in the intra abdominal pressure is dependent on the state of the collagen fibers that make up its tissues and

give its strength. The factor which interferes with normal production of collagen or causes its increased destruction or abnormal production of collagen fibers decreases the strength of transversalis fascia. These factors include congenital connective tissue disorders like Marfan's, Ehler Danlos and Hurler-Hunter syndromes and mesenchymal metabolic defects. It is found that substances in cigarette smoke inactivate anti-proteases in lung tissues and so upset the protease/antiprotease system which is responsible for destruction of elastin and collagen of the rectus sheath and fascia transversalis and predispose to herniation in smokers.

6. General Contributing Factors :

Like weakening of muscle and fascia by advancing age, lack of physical exercise, obesity and multiple pregnancies. Loss of weight and body fitness as may occur after illness, operation or prolonged bed rest, very low and unduly long transverse abdominal incisions for gynecological, urological and appendicectomy incision. Pulmonary diseases like COPD and emphysema, prostatism, chronic constipation, diverticular disease, genito-urinary causes like cystitis, cystocele and urethrocele contribute to the formation of groin hernia.

EPIDEMIOLOGY [15]

Inguinal hernias are more frequent in males than females in a ratio of 20:1 in different series. 64% of inguinal hernias in adult males are of indirect type. Right sided inguinal hernias in adult males are slightly more frequent than the left sided. 55% were on right side. Bilateral hernias are 4 times more common in direct than indirect. In western series, the peak incidence of groin hernias is after 65 years. The incidence of elective inguinal hernioplasty in adults is 90.5 per 100,000 populations and for emergency hernioplasty in adults 7.2 per 10,000 populations. The overall incidence of inguinal hernias in adults in the west varies between 7% and 18%.

Figure 8 : Indirect Inguinal Hernia right side

Figure 9 : Direct Inguinal Hernia right side

Components of Inguinal Hernia :

1. The sac:

   Different parts of the hernial sac:

Mouth : This is the part between the sac interior and the abdominal cavity.

Neck : This is the narrowest section between the mouth and the body of the sac.

Body : It lies between the neck and the fundus.

Fundus : This is the blind end or the distal most part of the sac.

The sac consists of a diverticulum of peritoneum, which is divided in to mouth, neck, body and fundus. This is funnel shaped in early stages of hernia. In cases occurring in infancy and childhood the sac is grossly thin. In chronic, longstanding hernia the sac becomes thickened and opaque or even cartilaginous and at times inflammation may cause adhesions between the inner wall and the contained viscera or between opposite sides of the sac, if no viscera intervenes.

2. Contents of Hernia

These can be almost any abdominal viscera, except the liver. The commonest are;

a. Fluid - Derived from peritoneal exudates, usually in congenital hernias..

b. Omentum - Omentocele (Synonym -Epiplocele).

c. A loop of intestine - Enterocele (Usually small intestine, but in some instances large intestine or vermiform appendix).

d. A portion of the circumference of the intestine - Richter's hernia.

e. A portion of urinary bladder wall or a diverticulum of the bladder.

f. Ovary with or without the corresponding Fallopian tube.

g. Meckel's diverticulum - Littre's Hernia.

h. Two loops of intestine in the manner of W - Maydl's hernia.

i. Rarely stomach, spleen or caecum may be found within the sac.

3. Coverings :

All the coverings of the sac of hernia are derived from the various layers of the abdominal wall, through which the sac passes. In a given hernia these coverings may vary as per the duration and size of the hernia. In long standing cases they become atrophied from stretching or become so amalgamated especially at the neck of the sac and often become so much thickened so as to produce strangulation.

Coverings in case of an indirect inguinal hernia are, from inside out, as follows:

a. Extra peritoneal fatty tissue

b. Internal spermatic fascia

c. Cremasteric fascia

d. External spermatic fascia

e. Two layers of superficial fascia

f. Skin

In case of a direct hernia the coverings are as follows

a. Extra peritoneal fatty tissue

b. Fascia transversalis

c. Conjoint tendon

d. External oblique aponeurosis

e. Two layers of superficial fascia

f. Skin

CLASSIFICATION OF INGUINAL HERNIAS

Clinical Classification :

This is based on the clinical presentation of hernia – like Reducible, Irreducible, Obstructed, Strangulated and Inflamed.

Reducible hernia: In this, contents of the sac can be completely reduced into the peritoneal cavity on their own or on manipulation. A reducible hernia gives an expansile impulse on coughing.

Irreducible hernia: When the content of the sac cannot be completely reduced into the peritoneal cavity. This can happen due to adhesions, narrowing of the neck or fixity of the contents of the sac.

Obstructed hernia (Incarcerated hernia) : Irreducibility + Features of intestinal obstruction. The features are:

a. The hernia is irreducible but painless.

b. The sac is lax and non tender.

c. Cough impulse usually absent.

d. Features of intestinal obstruction- constipation, vomiting, abdominal pain and distension. In this type of hernia there is no arrest of blood flow to the sac and its contents.

Strangulated hernia: Irreducibility + Features of intestinal obstruction + Arrest of blood supply to its contents leading to gangrene.

The features are:

a. The hernia is irreducible and painful

b. The sac is tense and tender

c. Cough impulse absent

d. Features of intestinal obstruction present

e. Intestinal obstruction may not be present particularly in case of omentocele, Richter's hernia and Littre's hernia

Inflamed hernia: A very rare condition and mimics in many aspects strangulated hernia. This occurs when it has as contents an appendix, a salphinx or a Meckel's diverticulum, which are inflamed. The features are

a. Overlying skin becomes red and edematous,

b. Swelling becomes painful, tender and swollen,

c. It is not tense and is not associated with intestinal obstruction.

Gilbert's Classification (Addition by Rutkow and Robbins)

It is based on anatomical and functional defects established intra operatively, namely the presence or absence of a hernial sac, the size and competency of the internal ring and the integrity of the transversalis fascia transverses abdominis aponeurosis layer within Hesselbach's

triangle. Gilbert categorized groin hernias in to 5 types. Type1, 2 and 3 were indirect whereas type 4 and 5 were direct.

Indirect Hernia

Type I ： Snug internal ring, intact canal floor.

Type II ： One finger breadth internal ring, intact canal floor. Not more than 4 cm.

Type III ： Two-finger breadth internal ring. Canal floor is defective (Scrotal and sliding hernias).

Direct Hernia

Type IV : Entire canal floor defective, no peritoneal sac anterior to anal floor, intact internal ring.

Type V : Diverticular defect, admitting no more than one finger, internal ring intact.

Other types

Type VI : Consists of both direct and indirect components.

Type VII : Covers all femoral hernias.

Nyhus Classification of Groin Hernias [16]:

Is based on strict anatomic criteria, focusing on functional state of the internal ring and posterior wall of the inguinal canal.

Type I : Indirect inguinal hernia -- internal inguinal ring normal (Congenital hernia).

Type II : Indirect inguinal hernia -- internal ring dilated but posterior inguinal wall intact, inferior deep epigastric vessels not displaced.

Type III : Posterior wall defects

A. Direct inguinal hernia.

B. Indirect inguinal hernia - internal ring dilated, medially encroaching or destroying the transversalis fascia of the Hesselbach's triangle. (e.g. Massive scrotal, Sliding or Pantaloon hernias).

C. Femoral hernia.

Type IV : Recurrent hernias

Classification as per the Patency of Processus Vaginalis :

It is classified into vaginal or congenital type, infantile type, funicular type and interstitial type.

Vaginal hernia: The processus vaginalis has failed to get obliterated in any part of its course. The hernia therefore descends to the base of the scrotum and the testis is behind it and is difficult to locate.

Infantile hernia: When the processus vaginalis is closed at the internal ring only and the hernia descends either behind the unobliterated processus or invaginating it. This hernia is difficult to diagnose clinically unless associated with an infantile hydrocele.

Funicular hernia: Here, the processus vaginalis is closed at its lower end, so the sac of the hernia is separate from the sac of the tunica vaginalis. The testis lies below the hernia and can be felt separately from the contents of the hernial sac. Most of the indirect inguinal hernias belong to this category and are commonly seen in adults. It is usually acquired but may be congenital.

Interstitial hernia: In this hernia the sac is caught between the different layers of the abdominal wall during development. Depending upon the position of the sac this type of hernia is further classified into three types:

A. Intraparietal or pre-peritoneal: when the sac lies between the transversalis fascia and the peritoneum.

B. Interparietal: when the sac lies between internal and external oblique abdominal muscles.

C. Extra parietal type: the sac lies superficial to the external oblique muscle. This type of hernia is often associated with ectopic or retractile testis. They give rise to inguinal swelling rather than inguinoscrotal swelling. By putting the abdominal muscles into action, it is possible to determine whether the hernia is superficial or deep to the abdominal muscles.

Classification Depending on the Contents of Hernia :

a. Omentocele or Epiplocele - when the sac contains Omentum.

b. Richter's hernia - when the sac contains a portion of circumference of the intestine.

c. Littre's hernia - the sac contains Meckel's diverticulum.

d. Enterocele -when the sac contains coils of intestines.

e. Cystocele - when the hernia contains the urinary bladder.

f. Other varieties are

1. Sliding or Hernia-en-Glissade (Contents - Caecum, Urinary bladder).

2. Maydl's hernia or Hernia-en-W (Contents-W shaped loop of intestine).

3. Hernia of vermiform appendix.

4. Hernia containing female reproductive organs.

5. Hernias containing some abnormal viscera like stomach, spleen.

6. Dual hernia (saddle or pantaloon). Hernia, on either side of the inferior epigastric vessels.

In Richter's hernia, part of the circumference of the intestine, which is herniated, in 5% of cases,undergoes strangulation. It is a serious and treacherous hernia, as it presents with mild obstructive symptoms, which may mislead the surgeon. In Maydl's hernia, W-shaped coil of intestine herniates through the inguinal canal. The segments of bowel proximal and distal to an infolded portion of hernia remain viable and free from effects of constriction and the central loop, which lies inside the canal in the peritoneal cavity, gets strangulated. In Littre's hernia, the sac contains Meckel's diverticulum. If the sac contains any other viscera it becomes a mixed Littre's hernia. In Sliding

hernia, sac is composed not only of peritoneum but in part by viscus such as caecum or colon, which has no complete peritoneal investment.

In cystocele, which occurs in direct type of hernia, usually a diverticulum rather than whole of bladder is found. Herniation of bladder into inguinal canal is classified into three varieties depending on the extent of peritoneal covering.

a. Extra peritoneal: Is rarest of the three varieties and bladder is usually opened mistaking it for the sac. In this variety, anterolateral surface of extra peritoneal part of the bladder is involved.

b. Para peritoneal: In this variety, bladder always lies on the inner side of the sac. The superior surface of the bladder forms the inner wall of peritoneal sac. This is the most common variety of the three and easily treated.

c. The intraperitoneal hernia: Is rare and is usually secondary in origin. The hernial sac lies lateral to the deep epigastric artery. The upper and posterior portion of the bladder enters the sac and in addition, loops of small intestine and omentum may be found.

Anatomical Classification :

In this type of classification, the location of the hernial sac in relation to certain anatomical structures is noted and accordingly the hernias classified. In case of inguinal hernia the landmark taken is inferior epigastric artery. Hernia lying medial to this artery is called as the direct hernia and that lying lateral to it called as the indirect hernia.

Classification according to Descent of the Sac :

A. Bubonocele: The hernia is limited to the inguinal canal, the processus vaginalis is obliterated at superficial ring.

B. Funicular: In this type, the processus vaginalis is closed only at its lower end, just above the epididymis. When the sac is occupied the contents of the sac can be separately felt from the testis, which lies below the hernia.

C. Complete: The processus vaginalis is patent throughout; the testis appears to lie within the lower part of hernia.

CLINICAL FEATURES OF INGUINAL HERNIA

History

Age: Inguinal hernias occur at all ages. They may be present at birth or appear suddenly in an 80 year old. Peak times of presentation are in the first few months of life, in the late teens and early 20's and between 10 and 60 years. Indirect hernias are seen in young individuals where as direct are seen in older subjects.

Sex: Males are 20 times more commonly affected than females.

Occupation: Heavy work, especially lifting puts a great strain on the abdominal muscles. If there is an underlying weakness, the appearance of a hernia may coincide with strenuous physical effort. Hard labor workers, sportsmen and weight lifters are more prone.

Associated diseases: Many a times, hernia is due to diseases causing weakness of anterior abdominal wall like obesity, previous lower abdominal operations, ascites and Malgaigne's bulges. Certain diseases lead to increase in abdominal pressure such as prostatic enlargement, stricture urethra, chronic cough and respiratory disorders and chronic smoking.

Local symptoms: The commonest symptoms are discomfort, heaviness and pain in the initial stages. The patient complains of a dragging, aching sensation in the groin, which gets worse as the day passes. A lump in the groin is the second most common complaint. This may be a small lump of 2-3 cm or a huge lump going down to the knee level. Patient feels that it gets smaller when he lies down and bigger when he strains or stands. If the hernia becomes very painful and tender, then it is probably strangulated. If hernia is reduced enmasse, patient may complain of pain on touching the scrotum. H/O frequency of micturition may be there in cystocoele.

Systemic symptoms: If the hernia is obstructing the lumen of a loop of bowel, the patient may complain of one or more of the four cardinal symptoms of intestinal obstruction – colicky abdominal pain, vomiting, abdominal distension and absolute constipation. In late cases of strangulation where gangrene has set in, patient can present with features of peritonitis, more so if perforation of bowel has occurred.

Signs

Inspection: In standing position, a bulge or swelling will be seen in groin. This might disappear on lying down, if the hernia is reducible spontaneously in direct hernia. Impulse on coughing is present in

reducible hernia. Loss of rugosities of scrotal skin in large inguino-scrotal hernias is seen. Visible peristalsis is seen in enterocoele. Malgaigne's bulges are seen in patients with lax abdominal wall. An indirect hernia is sausage or pear shaped and lies parallel to the inguinal ligament. After reduction it reappears more laterally and runs down above the inguinal ligament towards the scrotum. A direct hernia is more rounded, more medial, bulges forward and tends not to go down to scrotum. After reduction it reappears in a forward direction.

Palpation: Reducing the hernia by manipulation is called taxis and it is performed in lying down position of the patient. As the hernia is reduced following features are noted:

a. Gurgling sound is felt in enterocele.

b. In enterocele first part takes longer to reduce and in omentocele later part.

c. Impulse on coughing is felt.

Internal Ring Occlusion Test: Internal ring is occluded and patient is asked to cough. If a bulge is seen medial to the occluding finger, then it is a direct hernia, if not an indirect hernia.

External Ring Occlusion Test: After complete reduction, the external ring is occluded with a finger and patient is asked to stand up gently. The reducible inguinoscrotal swelling will not come down as its descent is prevented by occluding finger, where as swelling fills gradually from below in case of varicocele and lymphvarix.

Finger Invagination Test: After reduction of the hernia, this test may be performed to palpate the hernial orifice. The skin is invaginated from the bottom of the scrotum by little finger, which is pushed up to palpate the pubic tubercle. The finger is then rotated and pushed further up into the superficial inguinal ring. Normal ring is a triangular slit which admits only the tip of a finger. The patient is asked to cough. Normally by pinchcock action, the finger will be squeezed by approximation of two pillars. A palpable impulse will confirm the diagnosis of hernia. When the finger enters the ring, it goes directly backwards in direct hernia and it goes upwards, backwards and outwards in indirect hernia. The finger is again rotated so that the pulp of the finger faces backwards. The patient is again asked to cough. If the impulse is felt on the pulp of the finger, the hernia is a direct one, if it is felt on the tip, then it is an indirect hernia. “Sharma's ring”, may be felt in the sac during finger invagination test. It is a fibrotic ring which if felt in a

given case indicates liability to go for obstruction and hence surgery should be done at the earliest.

Three Finger Test Or Zieman's Technique: This test can be done only when there is no obvious swelling or after the hernia has been completely reduced. In this test the index finger is placed at the site of internal ring, middle finger at the external ring and the ring finger on saphenous opening. The patient is asked to cough, if impulse is felt at the internal ring, then it is an indirect hernia. If impulse is felt at external ring, it is a direct hernia and if impulse is felt at saphenous opening it is a femoral hernia.

Percussion: Over the swelling, tympanic, if it is an enterocele and impaired or dull in case of omentocele.

Auscultation: Bowel sounds will be heard in enterocele.

Always examine

1. External Genitalia

• Scrotum for thickened spermatic cord.

• Epididymis and Testes--whether absent or atrophic or a hydrocele is present. The external genitalia for stricture urethra,

• Prepuce for phimosis and External urethral meatus for pinhole meatus.

2. Per Rectal Examination: For benign enlargement of prostate and any other pelvic growth.

3. Per Abdomen Examination: To rule out any abdominal mass, ascites and Divarication of recti.

4. Respiratory System: To rule out COPD and Koch's.

Differential Diagnosis of Inguinal Hernia

I. When the swelling is incomplete i.e. an inguinal or a groin swelling:

a. Femoral hernia: The swelling is below the inguinal ligament and below and lateral to the pubic tubercle. In inguinal hernia the swelling is above the inguinal ligament and above and medial to the public tubercle. In femoral hernia, the inguinal canal remains empty when invagination test through the superficial ring is performed.

b. Enlarged Inguinal Lymph Nodes: Enlarged lymph nodes are found below the inguinal ligament, usually multiple with irregular consistency. Cough impulse is absent.

c. Saphena Varix: It is the saccular enlargement of the terminal part of the Great Saphenous Vein. The swelling is below the inguinal ligament and is associated with varicosities of the long saphenous vein. The swelling is soft and compressible. On coughing, the swelling imparts fluid thrill. The swelling disappears on elevation of the limb with the patient lying down. On auscultation, a venous hum may be heard.

d. Femoral Aneurysm: The swelling is below the inguinal ligament and on palpation there is an expansile impulse corresponding with the radial pulse. On auscultation, a bruit may be heard.

e. Encysted Hydrocele of the Cord: A smooth, elongated, tense, cystic swelling not reducible, cough impulse absent. On traction of the testis, the swelling comes down and becomes fixed. Transillumination is positive.

f. Lipoma of the Cord: Features are same as those of hydrocele of the spermatic cord but transillumination is negative. Cord feels soft and lobulated. No cough impulse.

g. Undescended or Ectopic Testis: Ipsilateral scrotum is empty. Cough impulse is absent unless there is a coexistent hernia. Characteristic testicular sensation is present on pressure over the swelling.

h. Psoas Abscess: A fluctuant swelling below the inguinal ligament. Cross fluctuation positive when the swelling is associated with iliopsoas abscess. The swelling may be partially reducible, but there is no true expansile impulse on coughing. There will be evidence of tuberculosis of the spine or hip on clinical and on radiological examination.

i. Malgaigne Bulges: Malgaigne described a bulge in the inguinal region which occurs in people of poor physique, but it has no cough impulse. It may be the precursor of a direct inguinal hernia.

j. Spermatocele: It is a poorly translucent cyst on the upper and posterior aspect of the testis.

k. Lymph Varix: In this condition the lymphatic vessels of the cord are dilated and tortuous because of obstruction secondary to filariasis. It gives an impulse on coughing and reduces spontaneously on lying down. It feels soft, cystic and doughy.

II. When the swelling is complete i.e., inguinoscrotal swelling.

a. Infantile Hydrocele: The swelling is fluctuant, translucent and irreducible. Cough impulse is absent.

b. Congenital Hydrocele: Occurs commonly in children. The swelling is fluctuant and translucent. It reduces very slowly.

c. Encysted Hydrocele of the Cord: Already discussed.

d. Varicocele: Presence of characteristic feel -- like Bag of worms. On coughing it imparts a fluid thrill. On lying down and scrotum is elevated the swelling reduces gradually and disappears. On standing the swelling reappears, fills up from the bottom of the scrotum, whereas the hernia descends from above and the descent can be prevented on deep ring occlusion test.

DIFFERENCES BETWEEN DIRECT AND INDIRECT HERNIAS

Points	**Indirect**	**Direct**
Incidence	75-80%	20-25%
Age	No age is exempted. Common in infants and young adults	Common in elderly people. (Generally after 35 years).
Sex .	Majority in males.	Uncommon or rare in Women
Size and shape	Oval, often massive and mm pear shaped.	Globular and small.
Site	Usually unilateral	Usually bilateral.
Extent	May be incomplete/ complete.	Usually incomplete.
Symptoms of straining	Usually present.	May be present.
Obstruction	May be present.	Usually not present.
Reducibility	Gradually, may need manipulation.	Immediately, on lying down.
Mode of reduction	Upwards, backwards and laterally.	Backwards.
On coughing	Emerges obliquely.	Emerges directly
Entrance	Through internal ring.	Though the floor of Hesselbach's triangle.
Exit	Through External Ring.	Rarely through external ring.
Deep ring occlusion test	Swelling does not appear.	Swelling reappears.
Direction of finger in invagination test	Upwards, backwards and laterally.	Directly backwards.
Cough impulse	Felt on tip of finger.	Felt at pulp of finger.
Preformed sac	Present.	Absent.
Relation of sac to cord	Anterolateral.(within cord)	Posterior.

COMPLICATIONS OF GROIN HERNIA[17]

Certain complications are well recognized. Others are not.

Irreducibility: When the contents of the sac cannot be completely emptied from the sac. This can happen due to adhesions, narrowing of the neck or fixity of the contents of the sac.

Strangulation: Strangulation means that the blood supply to herniated tissues is compromised. Hernia becomes strangulated when blood supply of its contents is seriously impaired, rendering the contents ischemic. Gangrene may occur as early as 5-6 hours after the onset of first symptoms. Pathology is obstructed intestine and impaired blood supply. If the strangulation is not relieved, perforation of the intestinal wall occurs and peritonitis ensues.

Incarceration: Incarceration is the state of an external hernia, which cannot be reduced into the abdomen; it implies an increased risk of obstruction and strangulation. Incarceration is caused by - A tight hernial sac neck; Adhesions between the hernial contents and the sac lining, sometimes a manifestation of previous ischemia and inflammation.

Reduction-en-masse: Can occur following an enthusiastic manipulation by the patient or his attendants, that forces the sac and its contents along with their coverings and reduce them intact, inside the abdominal wall or cavity. The testis will be retracted on the same side and gentle traction on the testis and spermatic cord will elicit 'Smiddy's sign. Or while reducing, the sac may rupture but the constriction ring at the neck remains intact, so that though the hernia is reduced, the obstruction/strangulation remains. If the hernia is not treated, may go for intestinal obstruction. Other rare complications include rupture of the hernial sac either spontaneously or due to trauma and testicular strangulation can occur in infants. Very rarely malignant mesothelioma has been encountered in hernial sacs.

Preoperative Investigations :

Careful history taking and thorough physical examination and investigations are of paramount for the assessment of patients for surgery.

A. Laboratory Investigations

1. Complete blood examination for Hb %, Total count, Differential count, Erythrocyte sedimentation rate, Fasting blood sugar, Blood urea and Serum Creatinine.

2. Urine analysis for Albumin, Sugar and microscopic organisms.

3. X-ray chest: To rule out TB, COPD, Emphysema and Malignancy of lungs.

4. Heart: To rule out atherosclerotic and ischemic heart disease.

Electrocardiogram and Echocardiogram in patients above 40 years is of high value.

5. Abdomen: USG abdomen, to rule out any tumors of colon, kidney, liver, ascites and size of prostate and residual urine.

6. Roentgen Studies in Hernia

a. Plain X-Ray Abdomen; In Intestinalobstruction, Incarcerated and Richter's hernia.

b. Barium Enema in sliding hernia.

c. Cystogram and IVP in sliding hernia

d. Herniography. This investigation is not done in our hospital.

Herniography[18] :

Positive contrast peritoneography used for the diagnosis of hernias in the inguino-femoral and pelvis region is called herniography.

Herniography is indicated primarily in patients with groin pain suggesting primary or recurrent hernia, which cannot be verified by clinical examination, and in patients with inconclusive clinical findings. In high-risk patients with manifest hernias, the appearance of a hernia on the herniographic picture can help the surgeon determine whether to operate or not and if operating, which surgical procedure to do. Herniography is used for scientific purposes as a sensitive and reliable method of diagnosing recurrent hernia in patients operated on, in clinical trials. Recurrences can be found before they become clinically manifest, and follow-up time may be reduced.

TREATMENT OF INGUINAL HERNIAS

Aim of treatment of inguinal hernia comprises of exposing the site of defect, correcting the anatomical defect, strengthening or reinforcing the deficiency in the posterior wall of the inguinal canal. Treatment of inguinal hernias is essentially surgical, exceptionally temporarily conservative, when efforts are made to keep the hernia in reduced state by clinical manoeuvering, till such time the patient becomes fit for surgery.

TYPES OF SURGICAL TREATMENT FOR INGUINAL HERNIA

Surgery is undoubtedly the treatment of choice. The types of operation are usually classified as:

Herniotomy: This is the essential and basic operation and it entails dissecting out and opening the hernial sac, reducing any contents and then transfixing the neck of the sac and removing the remainder. It is employed either by itself or as the first step in herniorrhaphy or hernioplasty. Herniotomy is sufficient for the treatment of hernia in infants and adolescents. In High herniotomy, the sac is removed at the level of deep inguinal ring.

Herniorrhaphy: refers to the strengthening or reconstruction of the posterior wall of the inguinal canal.

Indications:

1. Indirect inguinal hernia in healthy young adults with good musculature, in whom the deep ring is not stretched.

2. Adults in whom the internal ring is stretched.

3. Also suitable for large indirect inguinal hernia where the internal ring is stretched and posterior inguinal wall is distorted.Now, thought to be less efficient than repair by rectus sheath flap.

4. Also indicated as an injunction with other methods like Tanner's slide.

5. In indirect inguinal hernia where the hernia is small, provided that conjoint tendon is strong and the space between it and the inguinal ligament is narrow, to get a good result.

Aim of the operation: To narrow the internal ring and to reinforce the posterior wall of the inguinal canal with conjoint tendon.

Technique: Simple herniotomy is done. The lower part of the conjoint tendon and upper surface of the inguinal ligament are carefully cleared off fat and areolar tissue. The muscle and tendon are lifted forwards on finger and 4 to 5 stitches are inserted at about one centimeter interval between conjoint tendon and the inguinal ligament at medial end of the canal, since it is the site of maximum recurrence. To make sure of closing the medial gap it is advised to take the first bite through the periosteum of the pubic bone. The stitches should be introduced at different depths into the inguinal ligament in order not to cause splitting of the inguinal ligament along the line of suture. In placing sutures in the inguinal ligament, care should be taken not to injure the external iliac vessels, which lie immediately deep to the inguinal ligament. Non absorbable monofilament suture (prolene) is usually used but any other

suture material of surgeon's choice can be used. It is particularly important that the stitches should not be too tight. Care should be taken not to include the iliohypogastric nerve. The conjoint muscle should lay snuggly around the internal ring. Care should be taken not to tie the suture under tension. The cord is placed over the strengthened posterior wall and external oblique aponeurosis, sutured with interrupted or continuous suture. The skin wound is sutured.

Merits of Bassini's operation: It is easy to perform, less time consuming and recurrence rate in suitably selected cases is less. It is regarded as the standard method of hernia repair.

Demerits: Unphysiological, interference with the shutter mechanism of the internal oblique muscle: Weakens the defense of the posterior wall of the inguinal canal: Fails to protect the internal ring and is useless in recurrent and large hernia and in old people with poor musculature.

Hernioplasty : Herniotomy + reinforcement of posterior wall with the help of prosthetic material (mesh) . Considered gold standard now.

COMPLICATIONS OF INGUINAL HERNIA SURGERY

Nothing so prevents the occurrence of complications as one's awareness as well as fear of them. The complications cannot be eliminated altogether. They may be minimized by meticulous and precise surgical techniques.

Intra operative Complications

• Hemorrhage: Serious hemorrhage can occur, after trauma to one of the following

- Pubic branch of obturator artery, Deep circumflex iliac vessels or Inferior deep epigastric vessel and is troublesome.

-External iliac vessels must not be ligated and haemostasis should be achieved by applying pressure.

• Severance of nerves: The ilioinguinal, iliohypogastric and both the genital and femoral branches of the genitofemoral nerve are vulnerable to injury during groin hernia repair. Fortunately, there exists multiple cross connections between the peripheral nerves in the groin and considerable central segmental overlapping in their sensory representation. Prolonged anesthesia of skin does not follow injury to

one of these nerves. Anesthesia, if present in immediate postoperative period regresses by the 6th postoperative month.

• Nerve-entrapment by sutures: Results in prolonged postoperative symptoms. To avoid this, carefully identify the nerves and protect them during dissection.

• Severance of testicular blood supply: Every precaution should be taken to prevent damage to the vessels of the cord. If damage occurs, repair being impractical, ligation is necessary. Ligating the major artery to the testis at the level of the deep inguinal ring does not necessarily result in atrophy or necrosis of the testis, as long as the external collateral circulation is undisturbed. Preservation of this collateral circulation is accomplished by not dissecting the testis from the scrotum during hernial repair.

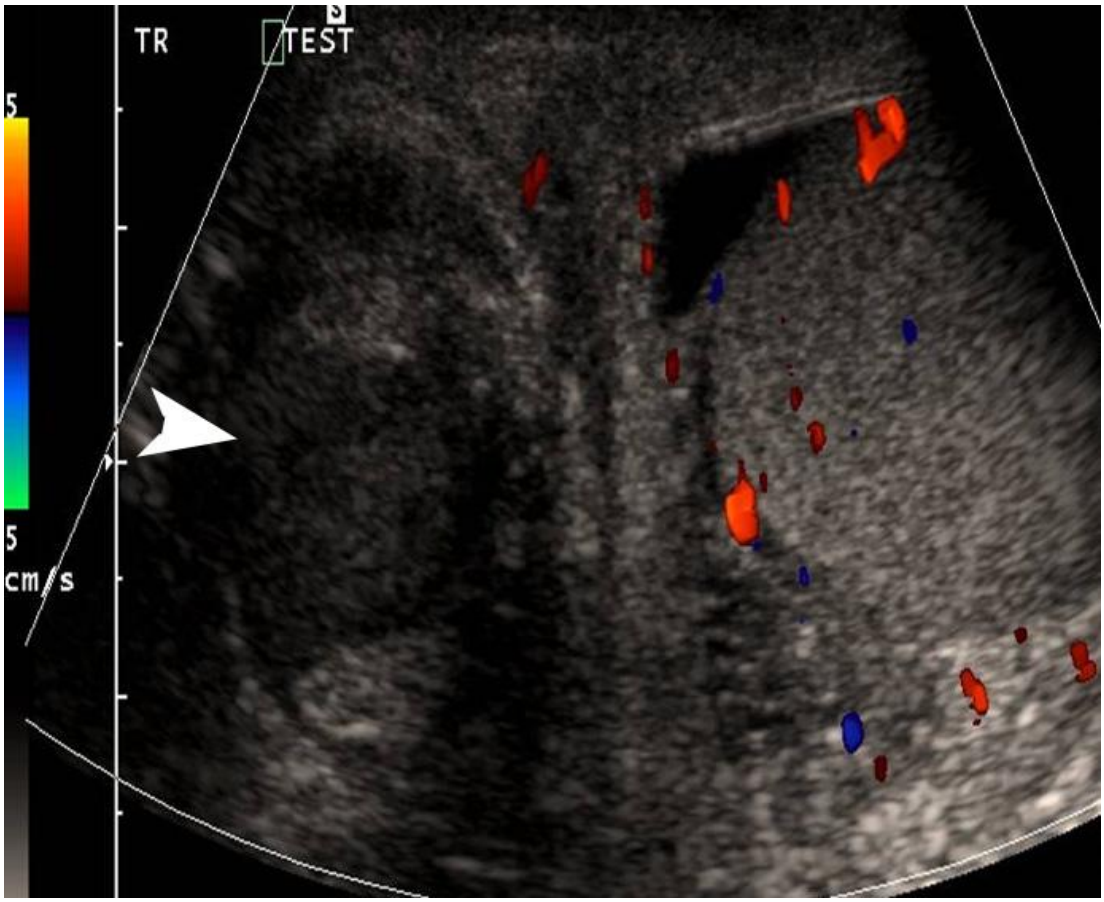


Figure 10 : Right Testicular Infarction in USG

• Trauma to vas deferens: Trauma to vas deferens can be of transection or obstruction. Transection is a mishap that usually occurs through open repairs, particularly in recurrent hernial repairs. Reanastomosis should be attempted with 'O' prolene as stent and with interrupted 3/0 chromic catgut. Obstruction can result from handling of the vas with forceps, causing fibrosis and adherence to posterior inguinal wall leading to outflow obstruction and dysejaculation, in 0.04% of herniorrhaphies.

Damage to intestine: Complications relating to bowel injury during open technique of hernia are limited to two situations, during freeing of incarcerated or strangulated segment of bowel and inadvertent laceration of large bowel in the presence of sliding hernia. The bowel may be injured either by entering it directly or may be devitalized by interrupting its blood supply. Incised bowel should be immediately repaired with interrupted seromuscular sutures using fine silk. Devitalized bowel must be dealt with either by exteriorization or resection.

• Injury to the bladder: Medial side of direct inguinal hernia often contains a sliding portion of bladder wall. If injury to bladder wall occurs, the defect should be closed in two layers with interrupted chromic catgut sutures and an indwelling urethral catheter inserted for 5 days. Repair of hernia should be completed after the bladder injury has been treated.

• Transection of spermatic cord: In rare instances, unintentional transection of the spermatic cord occurs during an operation.

Post operative complications

• General: Systemic complications occur at a rate comparable with that after other surgical procedures of the same magnitude. Atelectasis and

pneumonitis were most frequent followed by thrombophlebitis and urinary retention.

• Scrotal Ecchymosis: It manifests on the 2nd or 3rd post operative day. The skin of the scrotum becomes discolored, due to a dark purple ecchymosis. This complication results from oozing of blood from the dissected inguinal canal into the scrotum, following the path of spermatic cord. Ecchymosis resolves spontaneously within few weeks post operatively.

• Swollen Testis: Occurs due to too tight closure of tissues around the spermatic cord at deep ring or due to interruption of venous or lymphatic channels. Collateral lymphatic and venous channels usually develop in this situation and the swelling eventually subsides. Scrotal support and restricting general activity reduces the degree of discomfort.

• Ischemic orchitis and testicular atrophy: Ischemic orchitis is a syndrome that can occur after inguinal hernioplasty. It consists of painful, tender, swollen testicle and spermatic cord. Fever precedes testicular manifestations. The testicular abnormality is apparent only on 2nd or 3rd post operative day. The complication usually develops as the result of arterial or venous insufficiency or combination of both. Ischemic orchitis may resolve completely or progress to testicular

atrophy. It takes 4-5 months for the size and shape to return to normal. In most cases atrophy is apparent within few months of surgery. But in some patients ,it takes around 12 months before the atrophy is established. An atrophic testis is non tender and painless.

• Hydrocele: Collection of fluid in the scrotum or along the spermatic cord may result from leaving a portion of distal hernial sac in situ. Most of the large swellings due to fluid collection, respond to simple aspiration of the fluid with a needled syringe.

• Wound infection: The incidence of wound infection after prima repair of groin hernia is approximately 1% and in recurrent hernia it goes upto 3%. If, the infection extends below the external oblique aponeurosis recurrence becomes very high. Wound infection is managed by earl recognition, reopening of the wound to facilitate drainage and appropriate local care. Systemic antibiotics are indicated, if symptoms of invasive sepsis exist.

• Recurrence

A weakness in the operation area necessitating further operation. There is no question that, both through anatomical knowledge and skilled technique are necessary for successful repair. Absence of tension in the completed hernial repair is essential to the success of repair. A

hernia repaired under tension will not heal normally and is subject to disruption throughout the period of wound healing. Relief of tension is easily achievable by appropriate use of a relaxing incision, whenever a hernia, other than the smallest indirect inguinal hernia is repaired. Recurrence, after 6 months are due to factors other than technical error or selection of inferior procedure.

Recurrence is also due to decreased collagen synthesis. Prevention of recurrence is done by supplementing the basic repair with additional support by prosthetic mesh. The overall recurrence reported is 10% for primary and 25% for recurrent inguinal hernia.

• Missed hernia: A missed hernia is a hernial defect present at the time of primary hernial repair but unrecognized by the operator and appearing subsequently as a new hernia. Missed hernias can be avoided by careful inspection and palpation of all potential hernial areas in the groin, when the primary hernial repair is being conducted.

• Others: Urinary retention, Neuroma, Haematoma, Seroma, Sinus formation, Persistent post operative pain, Groin pain, (Common causes are abdominal muscle strain, nerve entrapment, neuroma, periostitis of pubic tubercle and adductor tendonitis, Numbness, Paraesthesia and Sexual dysfunction.

MATERIALS AND METHODS

This is a comparative study undertaken in the department of General Surgery in Government Rajaji Hospital, Madurai on the management of recurrent inguinal hernias for a period of one year starting from August 2013 to August 2014 in patients admitted in General surgical wards of Govt. Rajaji Hospital with recurrent inguinal hernia and undergoing surgery for recurrent inguinal hernia.

A total of 30 cases of Recurrent inguinal hernia were included in the study as per the following criteria :

1. A clinical diagnosis of uncomplicated Recurrent inguinal hernia.
2. Recurrent inguinal hernia with previous hernioplasty .
3. Patients above 13 years of age .
4. Patients medically fit for surgery.
5. Non diabetic patients.
6. Patients giving consent for study.

Cases or recurrent inguinal hernia with

1. Age below 13 yrs
2. Primary inguinal hernia
3. Recurrent inguinal hernia with previous herniorrhaphy
4. Other hernias of anterior abdominal wall
5. Previous preperitoneal / laparoscopic hernia repair
6. Unfit for anesthesia, (cardiac disease and COPD)
7. Unwilling candidates who were reluctant to oblige for the study
8. Complicated hernia. (Non-reducible, incarcerated inguinal hernia, Strangulated hernia)
9. Diabetic and immunosuppressed patients
10. Patients who have undergone prior pelvic lymph node resection or groin irradiation or open prostatectomy

were excluded from the study.

All the patients who were included in the study were studied with the help of a pre prepared proforma (ANNEXURE I).

The proforma included clinical history taking through questionnaires and physical examination. All patients underwent routine laboratory investigations and special investigations (ultrasound). After getting anaesthesia fitness patients were taken up for surgery under spinal anaesthesia. All patients were given a dose of pre op antibiotics. Two operative methods were used. Patients were allotted for either anterior approach or preperitoneal approach of surgery randomly.

OPERATIVE METHOD

ANTERIOR APPROACH :

` An elliptical inguinal incision was made starting from the pubic tubercle medially to the position of the internal ring laterally encircling the previous groin incision scar and scar was excised . The skin incision was deepened through subcutaneous tissue. The External oblique aponeurosis was incised and opened and its lower flap was freed from the spermatic cord. The upper flap of External oblique aponeurosis was freed from

previously laid mesh. The mesh was dissected all around and excised in toto. The spermatic cord was hooked up with the index finger near the pubic tubercle. A search was made for any direct sac. In case of a direct hernia, the sac was inverted and imbricated using a nonabsorbable suture (Prolene 2-0) to flatten the posterior wall. The cremasteric muscle was incised longitudinally, the cord structures were separated out and a search for indirect hernial sac was made. If an indirect sac was found, it was dissected free from the cord till the neck of the sac. The sac was opened. Any contents if present were reduced. The sac was then transfixed and excised. A sheet of 12 x 15 cm polypropylene onlay mesh was sutured with 2-0 polypropylene. The medial part of the mesh was trimmed appropriately. The inferomedial border of the mesh

was sutured to the soft tissues overlying Pubic Tubercle leaving 2-3 cm of mesh overlap here. The periosteum was avoided. The inferior border of the mesh was sutured in a continuous fashion to the inguinal ligament 2-0 polypropylene suture. A slit was made at the lateral end of the mesh, to fit the cord. The upper tail was passed around the cord, and was sutured to the inguinal ligament along with the narrow tail. In the same

way, the upper end of mesh was sutured in an intermittent fashion to conjoint tendon. Care was taken to protect the ilioinguinal and iliohypogastric nerves from entrapment in the sutures. The External blique aponeurosis was closed with 2-0 catgut subcutaneous tissue with 2-0 catgut and skin with 2-0 silk.

POSTERIOR APPROACH :

The preperitoneal approach accesses the groin using a groin incision 3cm above inguinal ligament well above the previous scar starting from midrectus extending for about 8 to 10 cm laterally. Incision was deepened through subcutaneous tissue. Anterior rectus sheath was opened at midrectus level and extended laterally. The rectus muscle was retracted medially. The transversalis fascia was incised and preperitoneal plane entered. The spermatic cord was identified at the internal ring and dissected proximally to the pelvic portion of vas deferens. Sac reduced. Cooper's ligament was identified medially and dissected free to expose its surface. Iliotibial tract identified. Dissection to this extent frees the peritoneum from the iliac fossa. Mesh 12 x 15 cm was placed in preperitoneal space and fixed to either coopers ligament or iliotibial tract. Transversalis fascia was closed with 2-0

vicryl, rectus sheath with 1-0 proline, subcutaneous tissue with 2-0 vicryl and skin with 2-0 silk.

During surgical procedure, following parameters were noted

1. Duration of procedure.
2. Per operative complications
    a) Injury to vas deferens
    b) Injury to testicular vessels
    c) Bowel injury
    d) Injury to urinary bladder

During the 2nd Post operative day patients were assessed for acute pain using Visual Pain Analog Scale.

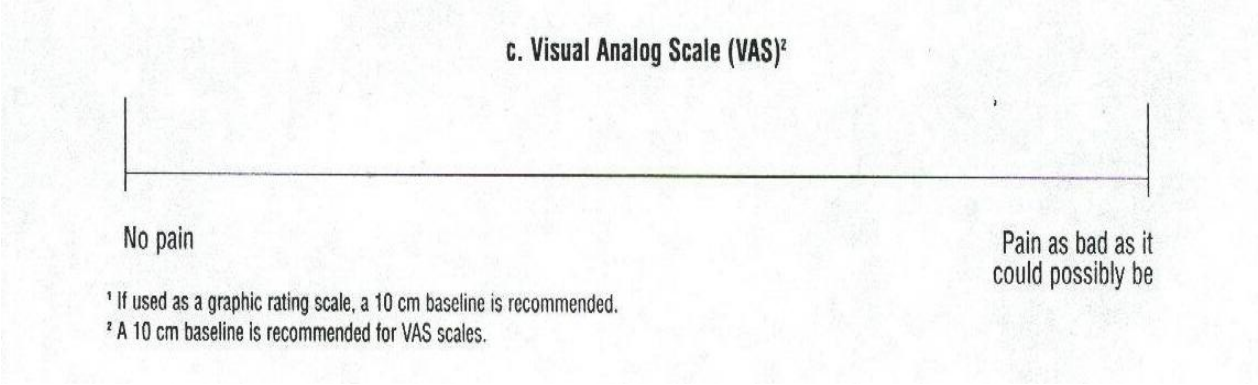


Figure 11 : Visual Pain Analog Scale

During the immediate post operative period patients were observed for development of hematoma or seroma.

Patients were discharged if there was no wound infection, were ambulatory, were taking orally and felt comfortable and the day of discharge was noted.

Patients were asked to come for review op on 1st week,1st month, 3rd month and 6th month. Follow up was done for detection of complications like chronic groin pain (inguinodynia) and testicular atrophy. Testis on operated side was compared with opposite side and if size appeared to be small it was confirmed with ultrasonogram of scrotum.

All the parameters mentioned above including Duration of procedure, Acute pain, Chronic pain, Per operative complications, Post operative hematoma, seroma, testicular atrophy and duration of stay were recorded. They were submitted for statistical analysis and compared with standard published literature.

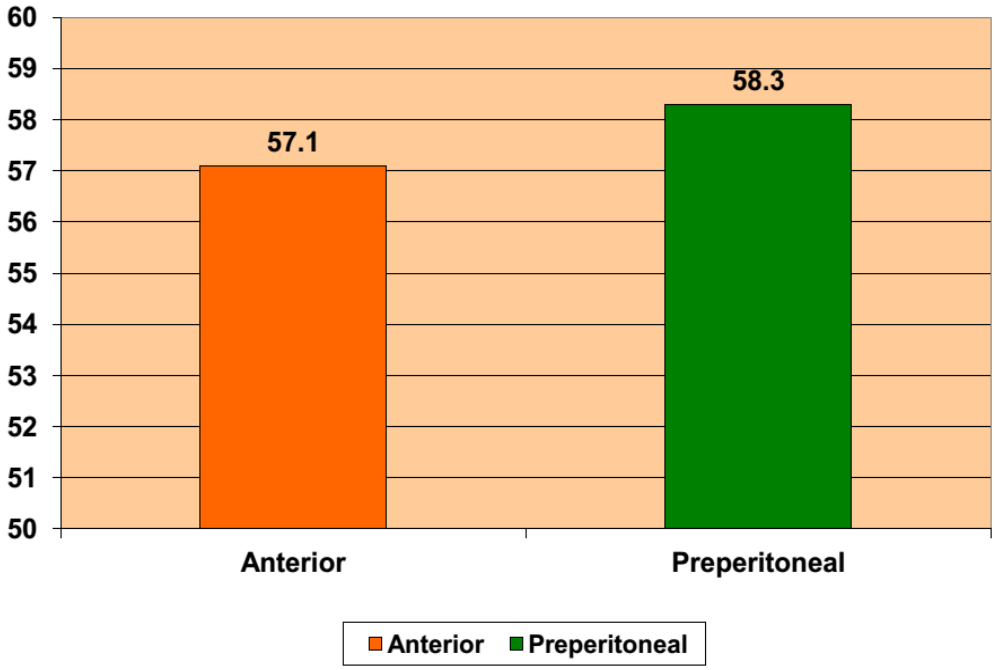
RESULTS

Age distribution among those who underwent anterior approach and preperitoneal approach was almost equal.

Table 1 : Age Distribution

Age Distribution	Anterior	Periperitoneal
< 40	0	1
41 - 50	3	4
51 - 60	10	2
61 - 70	1	7
> 70	1	1
Total	15	15
Mean	57.1 ± 9.22	58.3 ± 11.06
p value	0.749 Not significant	

Figure 12 : Age distribution

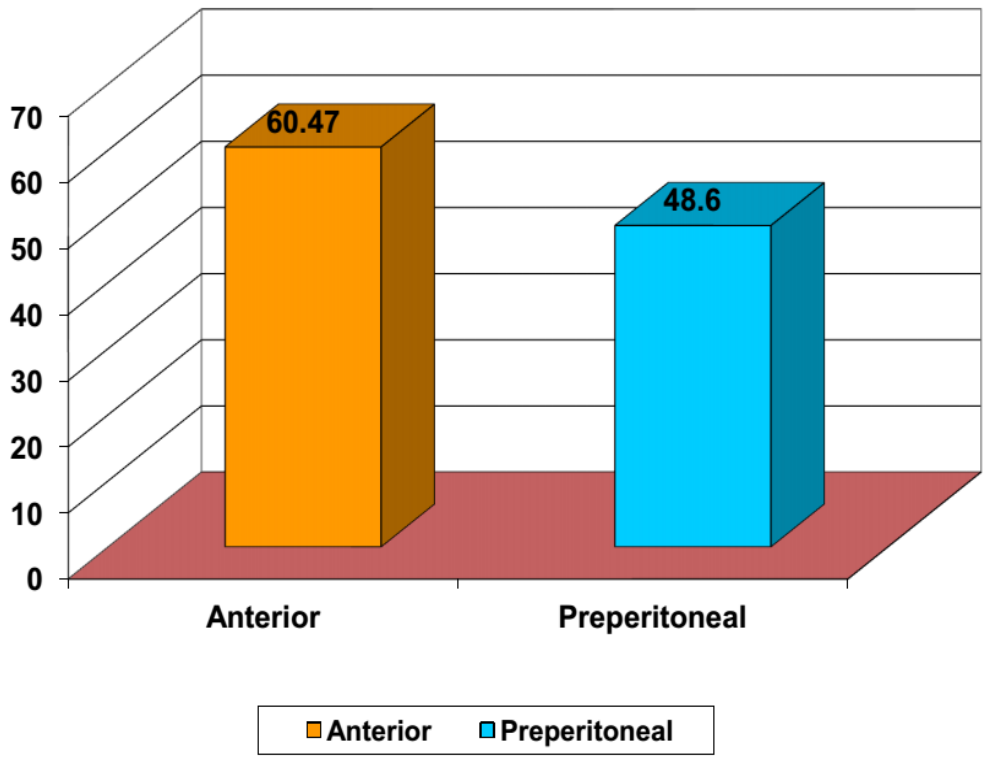


The duration of procedure was significantly low in preperitoneal group with 12 surgeries taking 40 - 50 minutes for complete procedure. In case of anterior group, none of the surgeries were completed within 50 minutes and 6 surgeries took more than 60 minutes for complete procedure. The mean duration of procedure for preperitoneal approach was 48.6 minutes compared to anterior approach which was 60.47 minutes with a significant p value of < 0.001.

Table 2 : Duration of procedure

Duration of Procedure (mts)	Anterior	Preperitoneal
40 - 50	0	12
51 - 60	9	2
> 60	6	1
Total	15	15
Mean	60.47 ± 8.19	48.6 ± 6.57
p value	< 0.001 Significant	

Figure 13 : Duration of procedure

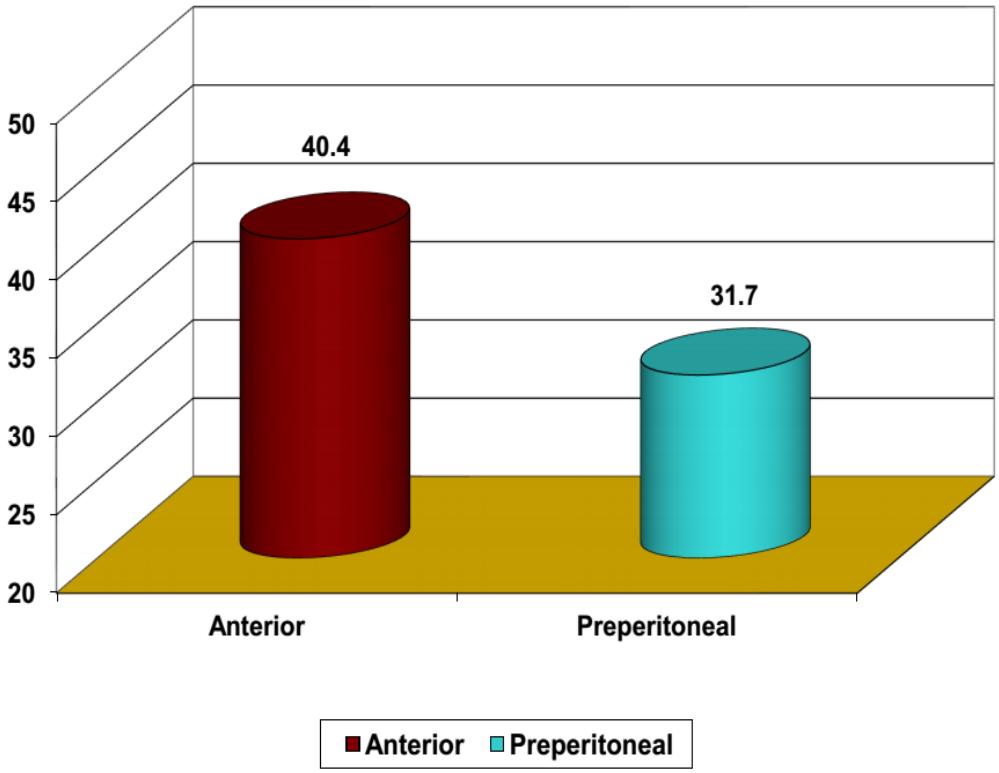


Acute pain recorded by Visual Pain analog scale on 2nd POD for preperitoneal approach ranged from 20 to 42 mm with a mean of 31.7 mm. Seven patients had pain less than 30 mm and only two patients had pain more than 40 mm. Acute pain in anterior approach group ranged from 30 to 48 mm with a mean of 40.7 mm. Only two patients in anterior group had pain less than 30 mm. The difference was significant with a p value of 0.001.

Table 3 : Acute Pain (millimetre)

Acute Post op Pain (2nd POD)	Anterior	Preperitoneal
< 30	2	7
31 - 40	5	6
41 - 50	8	2
Total	15	15
Mean	40.4 ± 5.62	31.67 ± 7.34
p value	0.001 Significant	

Figure 14 : Acute Post op Pain (2nd POD)

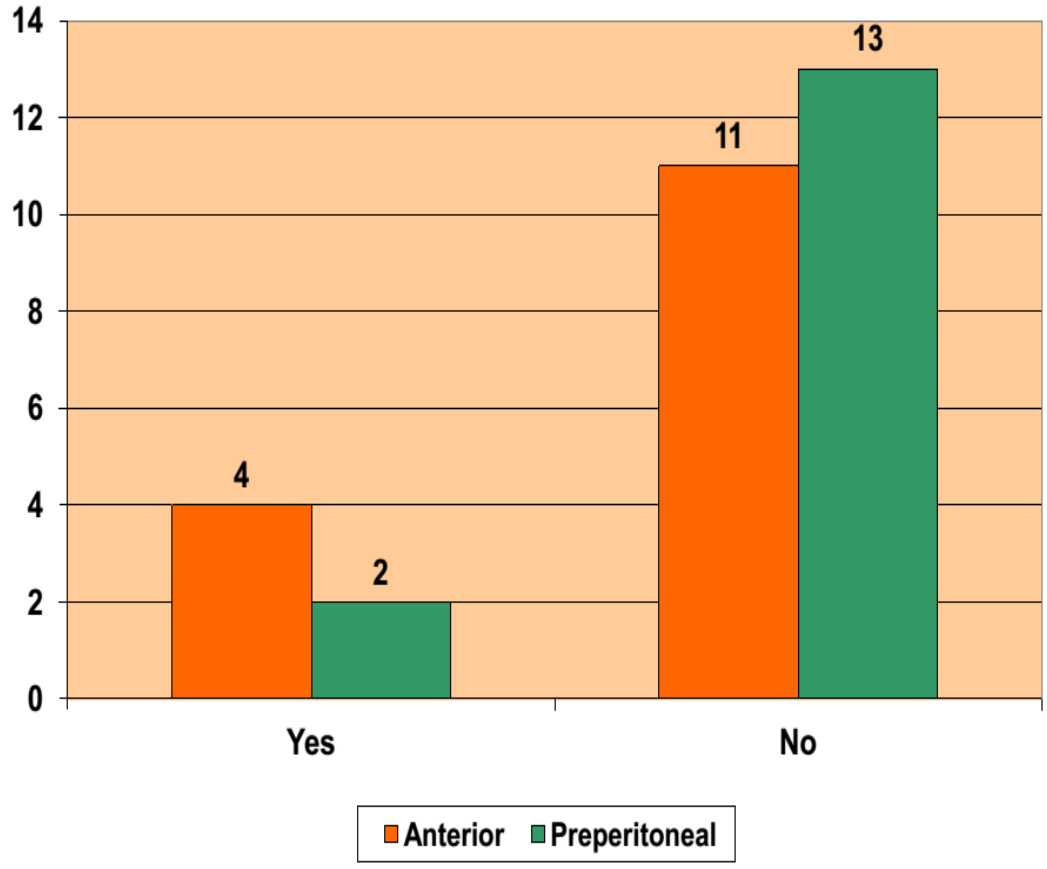


Two patients in preperitoneal approach group had chronic pain compared to four patients in anterior approach group. But the difference was not significant as the p value was 0.955.

Table 4 : Chronic pain (> 30 days)

Chronic Pain (> 30 days)	Anterior	Preperitoneal
Yes	4	2
No	11	13
p value	0.955 Not Significant	

Figure 15 : Chronic Post op Pain (> 30 days)

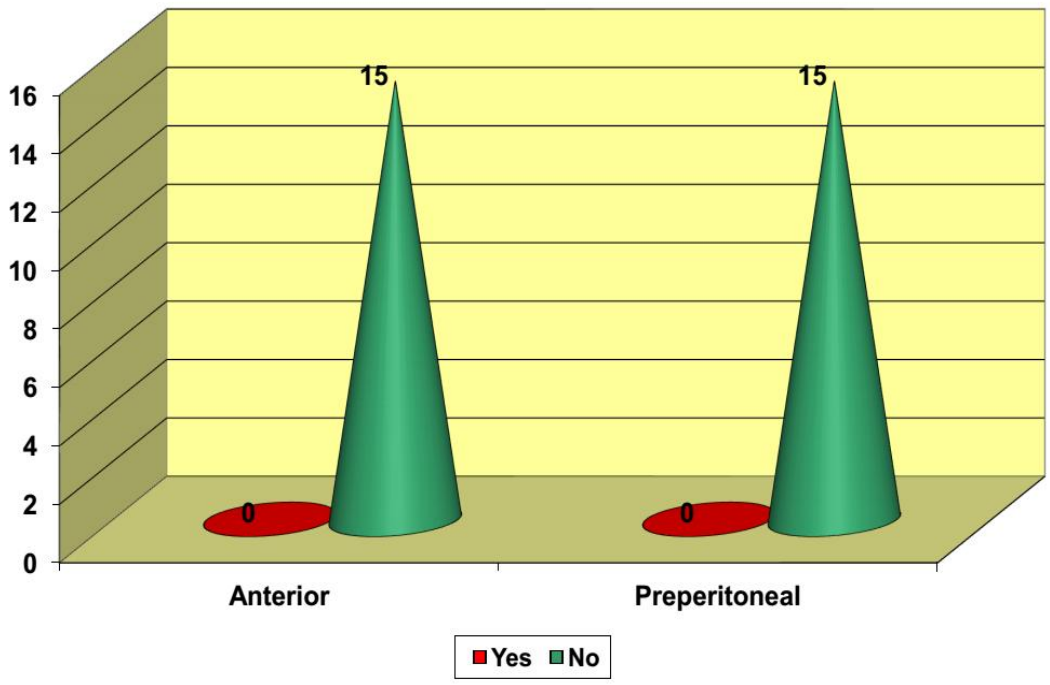


There was no incidence of any Per operative complications in both the groups.

Table 5 : Per operative complications

Peroperative complications	Anterior	Preperitoneal
Yes	0	0
No	15	15

Figure 16 : Per operative Complications

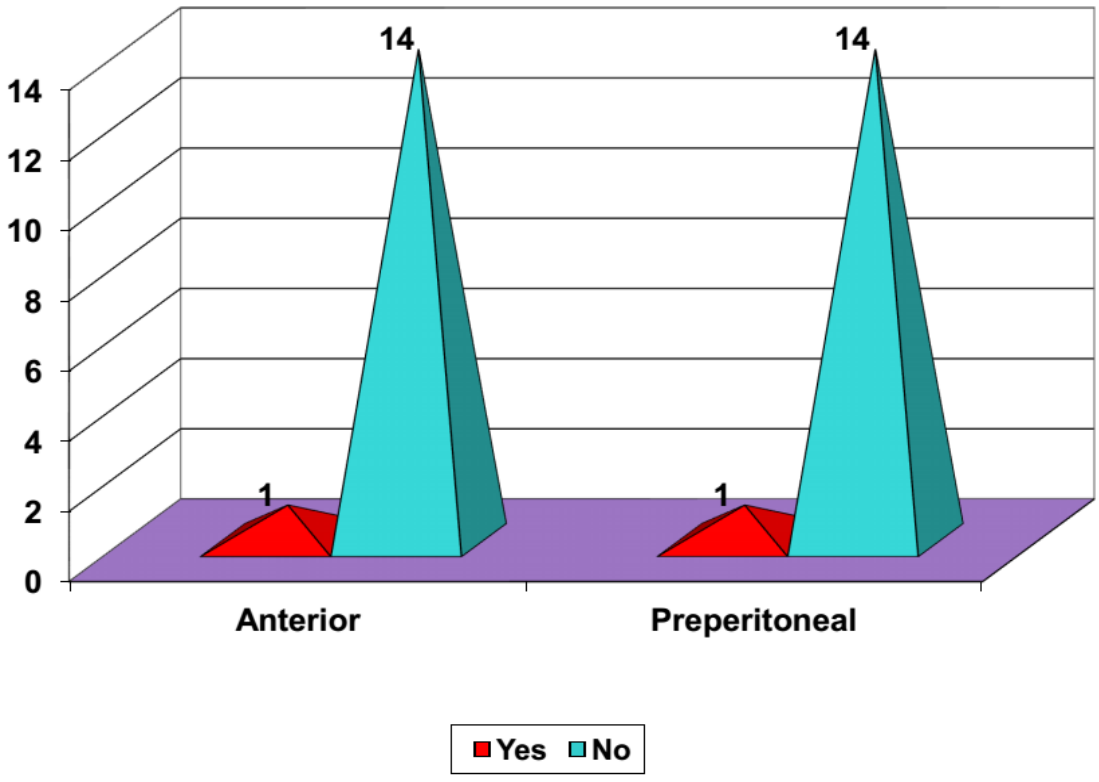


One case in preperitoneal approach and one case in anterior approach had incidence of hematoma in immediate post operative period.

Table 6 : Post operative Hematoma

Post operative Hematoma	Anterior	Preperitoneal
Yes	1	1
No	14	14

Figure 17 : Post operative Hematoma

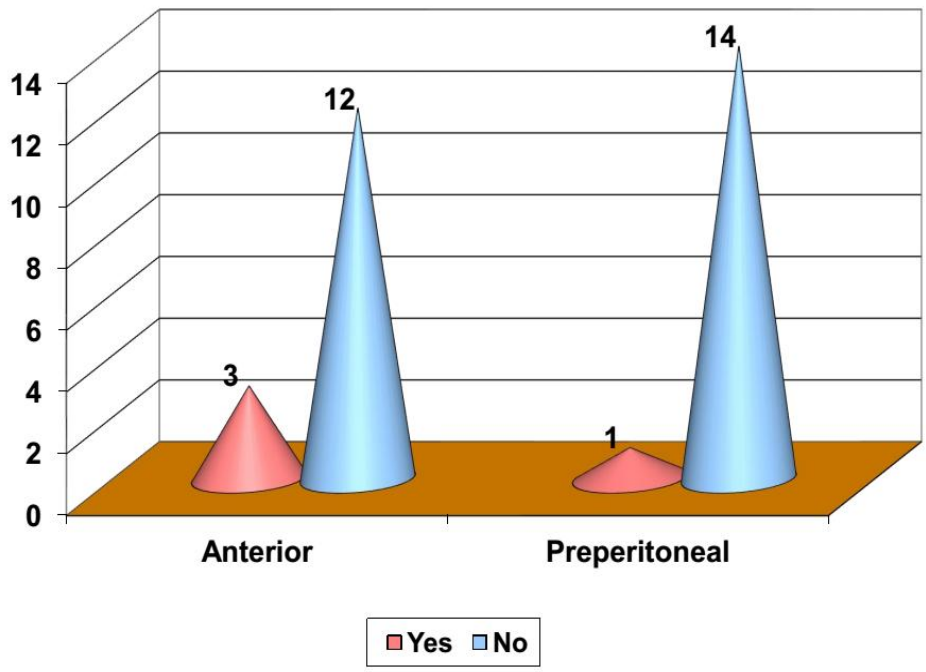


One case had incidence of seroma in preperitoneal group whereas three cases had incidence of seroma in anterior group. But the difference was not statistically significant.

Table 7 : Post operative Seroma

Post operative Seroma	Anterior	Preperitoneal
Yes	3	1
No	12	15
	P value	0.594

Figure 18 : Post op Seroma

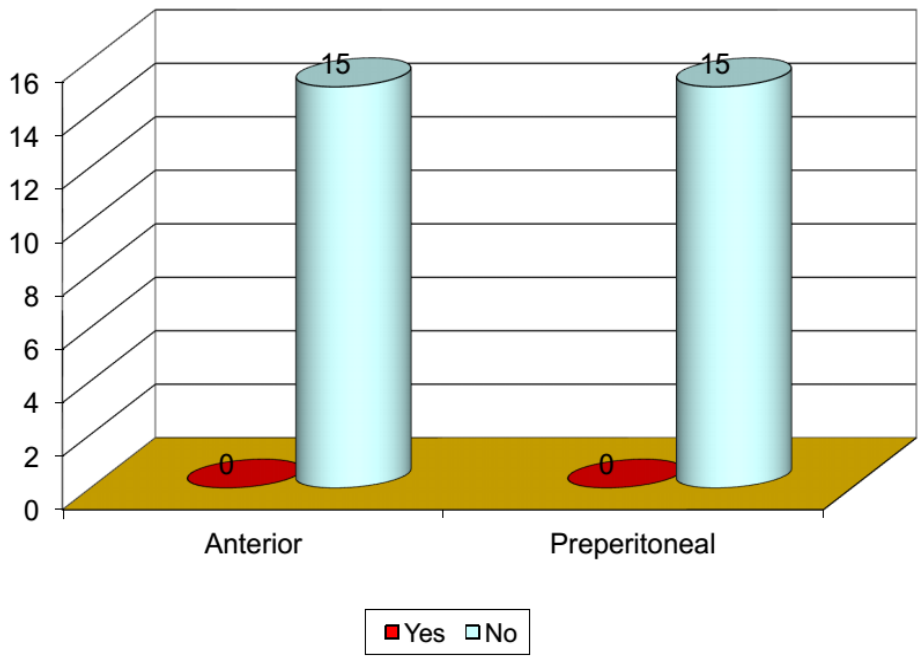


There was no evidence of Testicular atrophy in both anterior and preperitoneal groups.

Table 8 : Testicular atrophy

Testicular atrophy	Anterior	Preperitoneal
Yes	0	0
No	15	15

Figure 19 : Testicular Atrophy

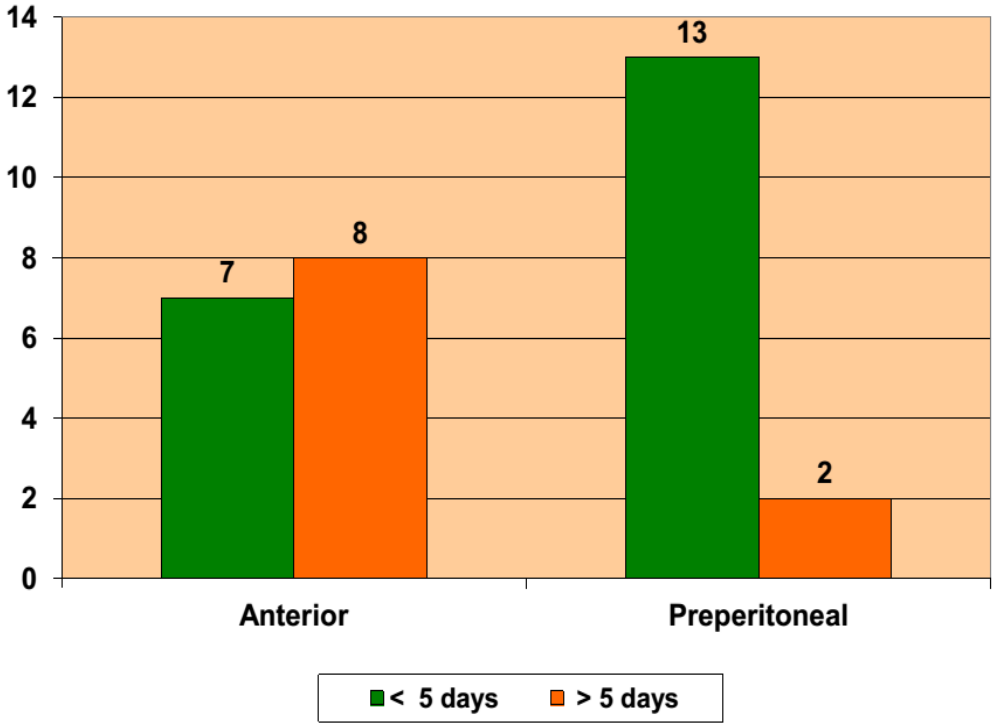


Mean duration of stay for Preperitoneal group was 4.06 days compared to anterior approach group wtih 5.47 days with a significant p value of 0.004.

Table 9 : Duration of stay

Duration of stay	Anterior	Preperitoneal
< 5 days	7	13
> 5 days	8	2
Total	15	15
Mean duration	5.47 ± 1.36	4.06 ± 1.03
p' value	0.004 Significant	

Figure 20 : Duration of stay



DISCUSSION

Recurrent inguinal hernia occurs mainly due to pre operative patient status like cough and BPH, defective collagen biology, poor surgical technique, post operative causes like wound infection. In words of Uwe Klige et.al., “Whereas recurrent and incisional hernias following suture repair are most likely caused by a defective biology, nevertheless the recurrence following mesh repair may be regarded as a technical fault, at least in theory”[19].

Whatever be the cause of recurrence, surgical technique and methodology is very important in the surgical management of recurrent inguinal hernia.

In this study comparing methodology, anterior approach and preperitoneal approach for recurrent inguinal hernia were compared. The results when compared with previous published studies show similarities in many aspects and differ in some aspects.

As old age is one of the factors causing increased surgical complications in inguinal hernia surgery, the age difference in the two groups was

submitted for statistical analysis and found to be not significant. The mean age between the two groups proved to be almost equal.

Duration of procedure :

The mean duration of surgery for preperitoneal approach was 48.6 minutes when compared with O Karatepe et.al.[20] with 44.56 minutes. Aly Saber et.al.[22] in their study showed preperitoneal approach to have less operative duration compared to anterior approach (71.6 minutes vs 94.7 minutes).These values when compared with the mean duration of surgery for anterior approach in my study (60.47 minutes), shows preperitoneal approach to be better than anterior approach in terms of duration of procedure.

Per op complications :

No preoperative complications like vessel injury, bowel injury and bladder injury were recorded in my study. However, Rubik Ray et.al. [21] report one case(2.7%) of vessel injury during preperitoneal approach in his study. O Karatepe et.al.[20] and Kurzer M et.al[23] reported no cases of preoperative complications during preperitoneal approach in their study. From these observations it can be safely concluded that preperitoneal approach is safe in terms of preoperative complications.

Acute Pain :

Pain recorded on second POD by visual analog scale was taken as acute pain in my study. Acute pain was significantly lower in preperitoneal group compared to anterior approach group (Mean 31.7 mm vs 40.4 mm). Willaert W et. al.[24] also reported similar conclusion in their meta analysis. Preperitoneal approach is similar to anterior approach in terms of reducing post operative acute pain.

Chronic Pain :

Pain recorded after 30th POD is taken as chronic pain in my study. Four patients in anterior approach group and two patients in preperitoneal group showed chronic pain in my study, but the difference was statistically insignificant. Li J et.al.[26] in their study came to similar conclusion. However, this conclusion differed from many previous studies reporting gross difference in chronic pain with reduced pain reported in preperitoneal approach. These studies include Giel G Koning et.al.[25], Rubik Ray et.al. [21] , Aly Saber et.al.[22] and Willaert W et.al.[25]. This study failed to demonstrate statistically significant difference in terms of chronic pain between anterior and preperitoneal group.

Post operative complications :

No statistically significant difference was made out between anterior and preperitoneal group with respect to hematoma, seroma and testicular atrophy, though there was more incidence of seroma in anterior group (3 cases vs 1 case). Except Aly Saber et.al.[22] who reported 5 cases of testicular atrophy in anterior approach group, several other studies including Rubik Ray et.al. [21], Li J et.al.[26] , O Karatepe et.al.[20] came to similar conclusions. Like Farooq O et.al.[27] and Kurzer M et.al[23], this study reports preperitoneal approach to be safe in terms of post operative complications.

Duration of stay :

Duration of stay was significantly low in preperitoneal group compared to anterior approach group (4.06 days versus 5.47 days). The mean duration of stay for preperitoneal group was reported to be 1.6 days by O Karatepe et.al.[20], 4.6 days by Rubik Ray et.al. [21], 1.2 days by Aly Saber et.al.[22]. Aly Saber et.al.[22] report low hospital stay duration in preperitoneal group (1.6 days vs 4.7 days). This study reports preperitoneal approach to be better in terms of duration of stay.

CONCLUSION

1. Open preperitoneal approach is better than anterior approach in terms of duration of procedure, acute and chronic pain, duration of stay.

2. No significant differences were made out between anterior approach and preperitoneal approach with respect to per op complications and post op complications including seroma, hematoma and testicular atrophy.

3. Open preperitoneal is safe in terms of having no preoperative complications and low postoperative complications.

4. Open preperitoneal approach should be considered a valid option in the management of recurrent inguinal hernias.

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ANNEXURE

Proforma

Sl.No.:	OP/IP No.:
Name:	Ward:
Age:	Unit:
Sex:	Admission date:
Address:	Discharge date:

1. Chief Complaints

2. History of Present Illness

- Swelling :

- Pain:

- Vomiting:

• Bowel habits:

• H/o passing blood in stools:

3. Past History

• H/o Diabetes:

• H/o previous surgery:

4. Personal History

• Smoker:

• Alcoholic:

5. General Physical Examination

Vital signs

• Pallor: Pulse:

• Cyanosis: Blood pressure:

• Clubbing: Respiratory rate:

• Jaundice: Temperature:

• Edema:

• LN:

6. Systemic Examination

Inspection of Swelling :

• Shape: Size:

• Situation:

• Cough Impulse:

• Reducibility :

• Scars:

• Any skin changes:

Palpation

•Warmth & Tenderness:

• Reducibility:

• Get above the swelling:

- Testis:

Percussion:

Auscultation:

BS :

Per rectal:

Prostate :

Cardiovascular system:

Respiratory system:

Central nervous system:

7. Investigations

Blood

Hb%: TC: DC: BT: CT: HIV:

ESR: Urea: RBS: S.creatnine Blood grouping:

Urine: Sugar: Albumin: Microscopy:

Serum electrolytes:

ECG:

X-ray:

X-ray of the chest:

USG:

8. Preoperative Diagnosis:

9. Treatment

- Operative management :

Anaesthesia:

Procedure :

Operative Time:

Intra Op Complications:

16. Postoperative treatment

Days :

Pain (2^{nd} POD) :

Visual Analog Scale pain score (mm):

Postoperative complications :

Wound :

Hematoma

Seroma

Chronic Pain : YES/NO

Post Op USG : (If clinically reduced testicular size)

`LIST OF TABLES

LIST OF PHOTOGRAPHS

MASTER CHART

S. NO.	NAME	AGE	SEX	IP NO.	SURGERY	DOP (min)	POST OP PAIN ACUTE 2nd DAY	CHRONIC >30 DAYS	POC	HE	POPC SE	TA	DOS
1	PANDI	60	M	36496	PREPERIT ONEAL	50	30	NO	NIL	NO	NO	NIL	4
2	KANDASAMY	66	M	12927	PREPERIT ONEAL	45	26	NO	NIL	NO	NO	NIL	3
3	KANNIAH	65	M	81178	PREPERIT ONEAL	42	34	NO	NIL	NO	NO	NIL	4
4	ARUMUGAM	38	M	4791	PREPERIT ONEAL	40	32	NO	NIL	NO	NO	NIL	3
5	SHANMUGAM	74	M	83843	PREPERIT ONEAL	50	40	NO	NIL	NO	NO	NIL	3
6	SUSAI	65	M	13364	PREPERIT ONEAL	45	36	NO	NIL	NO	NO	NIL	4
7	CHINNIAH	59	M	22768	PREPERIT ONEAL	60	42	YES	NIL	YES	NO	NIL	6
8	SUNDAR RAJAN	50	M	23336	PREPERIT ONEAL	46	45	NO	NIL	NO	NO	NIL	5
9	MAASANAM	62	M	4732	PREPERIT ONEAL	50	36	NO	NIL	NO	NO	NIL	4
10	MURUGAN	45	M	27085	PREPERIT ONEAL	62	22	NO	NIL	NO	NO	NIL	3
11	MAAMUNDI	67	M	27578	PREPERIT ONEAL	55	20	NO	NIL	NO	NO	NIL	4
12	DRAVIDAMANI	46	M	5E+05	PREPERIT ONEAL	50	24	NO	NIL	NO	NO	NIL	5
13	RAVICHANDRAN	43	M	32521	PREPERIT ONEAL	40	26	NO	NIL	NO	NO	NIL	3
14	PERUMAL	65	M	32501	PREPERIT ONEAL	44	30	NO	NIL	NO	NO	NIL	4
15	RAJU	70	M	36915	PREPERIT ONEAL	50	32	YES	NIL	NO	YES	NIL	6
16	KAALIMUTHU	81	M	39903	ANTERIOR	55	40	NO	NIL	NO	NO	NIL	4
17	PERIYAKARUPAT HEVAR	60	M	48045	ANTERIOR	66	42	NO	NIL	NO	NO	NIL	5
18	GOPALAKRISHNAN	49	M	32925	ANTERIOR	60	44	YES	NIL	NO	YES	NIL	7
19	JAYAKUMAR	45	M	36538	ANTERIOR	70	42	NO	NIL	NO	NO	NIL	6
20	NAJARAJAN	59	M	41890	ANTERIOR	48	36	YES	NIL	YES	YES	NIL	8
21	SUNDARAM	60	M	22482	ANTERIOR	50	48	NO	NIL	NO	YES	NIL	7
22	CHINNALAGHAN	55	M	16768	ANTERIOR	55	44	NO	NIL	NO	NO	NIL	6
23	KOODHANDY	51	M	35098	ANTERIOR	60	48	NO	NIL	NO	NO	NIL	6
24	PARAMAN	45	M	36705	ANTERIOR	66	46	NO	NIL	NO	NO	NIL	5
25	ISRAVEL	53	M	71201	ANTERIOR	70	40	YES	NIL	NO	NO	NIL	6
26	PERUMAL	70	M	81185	ANTERIOR	75	38	NO	NIL	NO	NO	NIL	6
27	SREEDHAR	60	M	21141	ANTERIOR	60	36	NO	NIL	NO	NO	NIL	5
28	KARUPIAH	58	M	7751	ANTERIOR	66	30	NO	NIL	NO	NO	NIL	4
29	RAJENDRAN	56	M	5320	ANTERIOR	56	30	NO	NIL	NO	NO	NIL	4
30	PERUMAL	55	M	34816	ANTERIOR	50	42	YES	NIL	NO	NO	NIL	3

KEY TO MASTER CHART

IP. NO.	In Patient Number
DOP	Duration of Procedure
POC	Peroperative Complications
HE	Hematoma
SE	Seroma
POPC	Postoperative Complications
DOS	Duration of Stay
TA	Testicular Atrophy

Ref.No.6506/E1/5/2014

Madurai Medical College,
Maduai -20. Dated: 11.09.2014.

Institutional Review Board/Independent Ethics Committee
Capt.Dr.B.Santhakumar,MD (FM). deanmdu@gmail.com
Dean, Madurai Medical College &
Government Rajaji Hospital, Madurai 625 020 . **Convenor**

Sub: Establishment – Madurai Medical College, Madurai-20 – Ethics Committee Meeting – Meeting Minutes - for August 2014 – Approved list – reg.

The Ethics Committee meeting of the Madurai Medical College, Madurai was held on 05th August 2014 at 10.00 Am to 12.00 Noon at Anaesthesia Seminar Hall at Govt. Rajaji Hospital, Madurai . The following members of the Ethics Committee have attended the meeting.

1.Dr.V.Nagarajan,M.D.,D.M(Neuro) Ph: 0452-2629629 Cell No.9843052029 nag9999@gmail.com.	Professor of Neurology (Retired) D.No.72, Vakkil New Street, Simmakkal, Madurai -1	Chairman
2.Dr.Mohan Prasad, MS.M.Ch. Cell.No.9843050822 (Oncology) drbkcmp@gmail.com	Professor & H.O.D of Surgical Oncology (Retired) D.No.32, West Avani Moola Street, Madurai.-1	Member Secretary
3. Dr.L.Santhanalakshmi, MD (Physiology) Cell No.9842593412 dr.l.santhanalakshmi@gmail.com.	Vice Principal, Prof. & H.O.D. Institute of Physiology Madurai Medical College	Member
4.Dr.K.Parameswari, MD(Pharmacology) Cell No.9994026056 drparameswari@yahoo.com.	Director of Pharmacology Madurai Medical College.	Member
5.Dr.S.Vadivel Murugan, MD., (Gen.Medicine) Cell No.9566543048 svadivelmurugan_2007@rediffmail.com.	Professor & H.O.D of Medicine Madurai Medical College	Member
6.Dr.A.Sankaramahalingam, MS., (Gen. Surgery) Cell.No.9443367312 chandrahospitalmdu@gmail.com	Professor & H.O.D. Surgery Madurai Medical College.	Member
7.Mrs.Mercy Immaculate Rubalatha, M.A., Med., Cell.No.9367792650 lathadevadoss86@gmail.com	50/5, Corporation Officer's Quarters, Gandhi Museum Road, Thamukam, Madurai-20.	Member
8.Thiru.Pala.Ramasamy, B.A.,B.L., Cell.No.9842165127 palaramasamy2011@gmail.com	Advocate, D.No.72,Palam Station Road, Sellur, Madurai-20.	Member
9.Thiru.P.K.M.Chelliah, B.A., Cell No.9894349599 pkmandco@gmail.com	Businessman, 21 Jawahar Street, Gandhi Nagar, Madurai-20.	Member

The following Project was approved by the Ethical Committee

Name of P.G.	Course	Name of the Project	Remarks
Dr.P.Negine Paul neginepaul@yahoo.co.in	PG in MS (General Surgery), Madurai Medical College & Govt. Rajaji Hospital, Madurai.	**A prospective study of open preperitoneal versus anterior approach for recurrent inguinal Hernia"**	**Approved.**

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain it Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution or to Government.
2. She/He should inform the institution Ethical Committee, in case of any change of study procedure, site and investigation or guide.
3. She/He should not deviate the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/He should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and if any Extension of time is required He/She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

Member Secretary
Ethical Committee

Chairman
Ethical Committee

11-9-14

DEAN/Convenor
Madurai Medical College & Govt.
Rajaji Hospital, Madurai- 20.

11/9/14

To
The above Applicant
-thro. Head of the Department concerned

Professor and Head
Department of Surgery
MADURAI MEDICAL COLLEGE
Govt. Rajaji Hospital
Madurai-20.

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Submission title:	A PROSPECTIVE STUDY OF OPEN..
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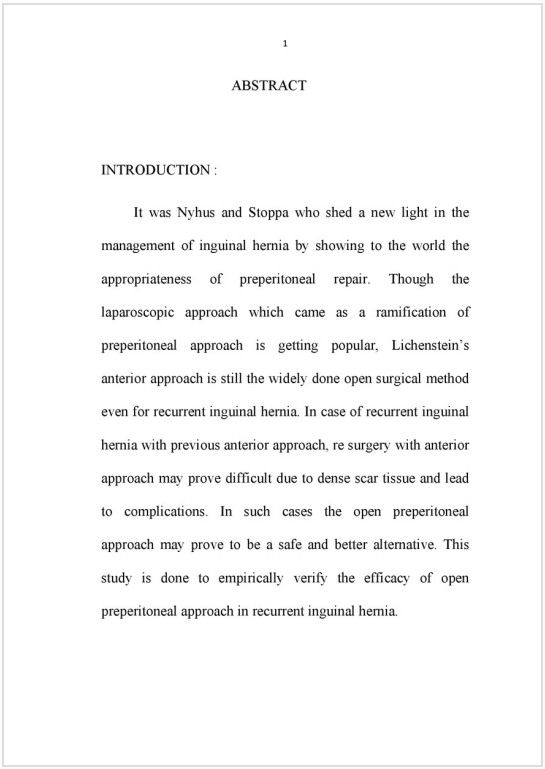

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ABSTRACT

INTRODUCTION :

It was Nyhus and Stoppa who shed a new light in the management of inguinal hernia by showing to the world the appropriateness of preperitoneal repair. Though the laparoscopic approach which came as a ramification of preperitoneal approach is getting popular, Lichenstein's anterior approach is still the widely done open surgical method even for recurrent inguinal hernia. In case of recurrent inguinal hernia with previous anterior approach, re surgery with anterior approach may prove difficult due to dense scar tissue and lead to complications. In such cases the open preperitoneal approach may prove to be a safe and better alternative. This study is done to empirically verify the efficacy of open preperitoneal approach in recurrent inguinal hernia.

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